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ABSTRACT

This publication presents abstracts of currently active science education projects which are supported by the Division of Science Education Development and Research (SEDR) of the National Science Foundation (NSF). These projects are directed to all academic levels to improve the quality of science education from the level of kindergarten to that of the graduate school and from the development of specific instructional materials, methods and technology to basic research in science education itself. Projects are presented under two areas: (1) Development in Science Education; and (2) Research in Science Education. Each project abstract is presented in one page which provides information about project objectives, amount of grant, award date, termination date, NSF program manager and project director. (HM)

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THE DIVISION OF SCIENCE EDUCATION DEVELOPMENT AND RESEARCH (SEDR)

PROJECT ABSTRACTS OF ACTIVE GRANTS

February 1979

As one part of the National Science Foundation's Directorate for Science Education, SEDR fills the important function of emphasizing and offering support to activities that are directed towards the development of new knowledge in and new means of improving education in science. The current effort is directed to all academic levels as you will note when you look over the contents of this booklet. Support has been offered to improve the quality of science education from the level of kindergarten to that of the graduate school and from the development of specific instructional materials, methods and technology to basic research in science education itself.

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NOTE: Data for this report were taken from program records and may therefore differ from official National Science Foundation source documents which have been generated from the Management Information System data base and may contain different inclusions or exclusions.

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NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

ISSUE-ORIENTED INSTRUCTIONAL MODULES FOR INTRODUCTORY COLLEGE PHYSICS CLASSES

Dr. Arnold Strassenburg
American Association of Physics Teachers
State University of New York at Stony Brook
Stony Brook, New York 11794

Eighteen instructional modules of materials on physics related to contemporary social issues will be provided over a three year period. Each module will be for introductory physics and will contain one week of student work. Issues such as energy shortages and X-ray safety will be covered and related to each of the major content areas of physics.

Some of the modules will be produced by authors who enter a nationally announced contest, while others will be completed by commissioned authors. Authors will be provided with results of needs assessment, a survey of likely student characteristics, and an assay of useful resources on which to build their writing. All modules will be field tested and then revised by a writing team. Following this revision a publisher will be sought for the instructional materials.

Development in Science Education
SED77-19304
$72,780
Award date: 09/28/77
Termination: 09/30/80
NSF Program Manager:
Dr. Gregg Edwards

12/1978

UNDERGRADUATE EDUCATION IMPROVEMENT IN POLITICAL SCIENCE: INNOVATION IN INSTRUCTIONAL MATERIALS

Sheilah K. Mann
American Political Science Association
Washington, D.C. 20036

Toward the end of 1972, the American Political Science Association began a major NSF-supported effort to conduct a set of educational studies, increase teacher awareness about educational issues, and prepare instructional materials in political science. Progress to date includes: (1) The conduct of national surveys on learning and curriculum in Political Science, (2) implementation and evaluation of workshops and panel sessions, (3) publication of reports and essays dealing with educational strategies, philosophies, modes, and other issues, (4) establishment of a national Political Science news organ, and (5) development, evaluation, and distribution of instructional materials that provide descriptions and analyses of learning resources, and others that deal with the use and analysis of social science data sets.

The proposed work will complete testing, revision, and dissemination of some materials. New materials focusing on cognitive analytical skills will be developed, evaluated, and disseminated. Educational policy and assessment activities will be expanded and institutionalized by APSA and the Political Science discipline. Instructional and materials development activities will be established on a self-sustaining basis to phase out NSF support by the end of the grant period.

During the past year, a competitive solicitation of module developers was completed, initial drafts of 12 analytical units have been prepared, and six empirical units and six educational essays have been brought close to completion.

Development in Science Education
SED77-18486
$212,130
Award date: 09/29/77
Termination: 03/31/80
NSF Program Manager:
Dr. Gene D'Amour

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

OUTLINES IN MICROBIOLOGY FOR COMMUNITY AND JUNIOR COLLEGES

Dr. Helen L. Bishop
American Society for Microbiology
Washington, D. C. 20006

The rapid increase in student enrollment and the growth of academic programs in Community and Junior Colleges has created a need for instructional materials in microbiology. The Board of Education and Training, through its Committee on Undergraduate and Graduate Education, will organize bodies of scientific knowledge so that teachers in Community and Junior Colleges can extract portions according to their needs. There are four units of concern: Introductory Microbiology, Medical Microbiology, Microbial Physiology, and Microbial Genetics. Each unit is to be organized into topics outlines followed by essential, enabling laboratory and enrichment information.

In the first Phase, a Steering Committee, composed of teachers from Community and Junior Colleges and from degree granting institutions, established guidelines for the project. In the second Phase, the actual units will be produced by four Study Groups, selected by the Steering Committee. The Study Groups will be composed of Community and Junior College teachers currently teaching microbiology, content specialists and an education expert. The units will be reviewed by a large group of content specialists and teachers identified by the Steering Committee. After appropriate evaluation, the units will be made available for purchase as individual publications.

Development in Science Education
SED77-18459
$76,330
Award Date: 09-08-77
Termination: 06-30-80
NSF Program Manager:
Dr. Linda Kahan

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

TEACHING MATERIALS IN MICROBIOLOGY

Dr. Helen Bishop
American Society for Microbiology
Washington, D. C. 20006

The first year of this project was devoted to the compilation and evaluation of existing audio-visual and meeting materials, and the publication of a catalogue of these materials, "Multimedia Programs in Microbiology." Instructional aids not then available were identified by the advisory committee.

In the early part of the second year, proposals were solicited for development of the identified instructional materials. Selection criteria were (1) appropriateness of materials, (2) facilities available to produce high quality materials, and (3) the competence of the proposers. Eighteen proposals were eventually selected for development in three rounds of competition.

During the remaining 18 months of the project, the materials developed in the individual proposals will be evaluated by the advisory committee and revised by the authors. They will then be distributed commercially.

Development in Science Education
SED76-02877
$178,575
Award date: 06/15/76
Termination: 02/29/80
NSF Program Manager:
  Dr. Linda Kahan

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

DEVELOPMENT OF A MOBILE SPECTROSCOPY LABORATORY

T. D. Roberts
University of Arkansas
Fayetteville, Arkansas 72701

This proposal seeks support to buy, equip, maintain, and stimulate the use of a truck-borne, mobile chemistry laboratory, containing a wide variety of sophisticated, analytical equipment. This mobile laboratory will circulate on a pre-arranged schedule, stopping one to three weeks on the campuses of 12 participating small colleges in Arkansas and Kansas. Students at these colleges would utilize the instruments to perform locally determined experiments which will be an integral part of their ongoing chemistry curriculum under the supervision of the regular on-campus instructors. Students will be prepared by pre-arrival lectures on the use of the instruments, and professors involved in the program from each of the 12 campuses will meet at a workshop during the summer of 1975 in order to familiarize themselves with the instruments and to coordinate the scheduling. It is planned that within 3-5 years, the mobile laboratory will be completely supported by the participating schools.

Development in Science Education
SED75-14376
$193,000
Award date: 06/12/75
Termination: 05/31/79
NSF Program Manager:
Dr. Gene D'Amour

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

TEACHING AND LEARNING IN GRADUATE GEOGRAPHY

Dr. William D. Pattison
Association of American Geographers
Washington, D. C. 20009

The project in teaching and learning in graduate geography was initiated in the spring of 1973 under an NSF grant through the Advanced Science Education Program to foster the first phase of development and implementation of an alternative philosophy of education among geography doctoral programs. It was renewed in 1974 for continuation through the second phase of expansion and sharing. The chief overall objective is to improve teaching at the college and graduate level via an array of varied and essentially self-sustaining programs in the teaching-learning arts at a number of universities and to seek to establish a national leadership corps in higher education in geography. Initially there were five partially supported pilot programs; during the period of NSF funding, sixteen departments of geography have developed and sponsored teaching preparation programs for graduate students and have been provided liaison under the NSF grant.

The final phase will cover dissemination and a follow-up evaluation study of all of these teacher preparation programs. It is expected to develop a clearinghouse of information to provide assistance for doctoral departments wishing to initiate programs in the teaching/learning arts in geography. The follow-up evaluation will attempt to determine whether the sixteen programs developed have resulted in an improved population of teachers of geography at college and university levels. This study is considered of importance to the AAG in the decision to continue or initiate further teaching preparation programs.

Development in Science Education
SED76-01668
$72,700
Award Date: 04-12-73
Termination Date: 03-31-79
NSF Program Manager:
Dr. Linda Kahan

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

STUDY ON COURSES IN COMPUTER LITERACY AND THE IMPACT OF COMPUTERS ON SOCIETY

Dr. Richard H. Austing
Association for Computing Machinery, Inc.
1133 Avenue of the Americas
New York, New York 10036

The purpose of the activity is to study and organize materials in the area of Computer Impact on Society and Computer Literacy and through assistance of computer and educational experts develop a guide recommending goals, resources and materials to assist teachers and curriculum developers in designing courses. The audience is university and secondary school instructors and curriculum developers.

The completion of phase 1 of the Study of Computer Impact on Society and Computer Literacy Courses and Materials has led to the collection of an extensive annotated bibliography in the area, and the development of course objectives for various educational levels. The current activity seeks to continue this work in three basic activities: 1) further develop and refine the bibliography and the information storage and retrieval system supporting it, 2) organize and conduct a workshop on computer impact involving individuals other than computer professionals, and 3) develop and disseminate a collection of position statements in the area of computer impact by various concerned professionals.

Development in Science Education
SED76-84222
$63,826
Award date: 08-26-77
Termination: 03-31-79
NSF Program Manager:
  Dr. Andrew R. Molnar

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

DISSEMINATION OF INSTRUCTIONAL MATERIALS
(History-of-Physics Laboratory)

Dr. Samuel Devons
Barnard College
New York, New York 10027

This project would put into a form suitable for dissemination to many schools the results and materials developed during an earlier grant (GY-4712). It would produce learning packages composed of booklets, films, and experimental guides, as well as reproductions of some historical paraphernalia, so that students either in self-study or as part of a lecture supplement program could understand better the historical background and development of crucial scientific principles of physics and chemistry.

Development in Science Education
SED74-17738
$117,240
Award: 06-24-74
Termination: 03-31-79
NSF Program Manager:
Dr. Gregg Edwards

12/1978

A 8

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

DEVELOPMENT OF INSTRUCTIONAL FILMS IN ETHOLOGY-- "BEHAVIOR OF THE RING DOVE"

Dr. Rae Silver
Barnard College
New York, New York 10027

To produce three coordinated versions of a teaching film on the behavior of the ring dove, emphasizing the relationship of endocrinal functions to its biological cycles and behavioral patterns. These three versions will be targeted, respectively, toward (a) precollege nature study/biology, (b) undergraduate biology and comparative psychology/graduate level endocrinology and ethology, and (c) a general public environmental education film for TV distribution. With all film footage requirements pre-identified, sufficient film can be exposed in a single trip to the remote location, unused footage being earmarked for national cinematographic archives.

Associated and concurrent studies into improved production and utilization efficiencies include: (a) basing the entire plan on a preliminary study by educational-film utilization experts who will identify existing related films (so as to prevent unplanned duplication), define the educational needs, teacher attitudes and target audiences (so as to concentrate on what is known to be needed), and pre-plan the educational strategy for the entire complex of films (including story lines) before shooting begins (so as to minimize production costs); (b) coordinating this group's findings with scientific accuracy, film quality and educational impact; (c) experimenting with combinations of strategies to maximize market penetration (and thus improve cost effectiveness); and (d) documenting and evaluating each step in a manner calculated to show how to increase the educational returns from investments in teaching films.

Development in Science Education
SED77-12124
$193,000
Award Date: 09-21-77
Termination Date: 09-30-80
NSF Program Manager:
Dr. Linda Kahan

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

HUMAN SCIENCES PROGRAM (HSP): A THREE-YEAR INTEGRATED HUMAN SCIENCES CURRICULUM FOR MIDDLE SCHOOLS

Dr. William V. Mayer
Biological Sciences Curriculum Study Company
Box 930
Boulder, Colorado 80302

The Human Sciences Program is designed as an interdisciplinary science offering for middle or junior high school students (ages 11 to 14) and focuses on the natural sciences, including interfaces with the social-behavioral sciences, to form the content of the instructional program. HSP is further based upon educational theory that accommodates the needs, interests and developmental characteristics of emerging adolescents as well as the variability in the tastes of individual families and communities. Fifteen modules, each accommodating approximately eight weeks of classroom activities, have been developed and field tested in representative schools across the country.

This award provides continuing support for 1) analysis of the entire three-year sequence based upon data acquired during field testing, 2) utilization of quality control procedures to insure the accuracy, integrity and appropriateness of the final program, 3) development and testing of management resource materials for the entire program, 4) development of student evaluation materials, and 5) final revision of the entire program in preparation for publication and commercial distribution.

Development in Science Education
SED72-06305
$3,131,032
Award date: 10-11-72
Termination: 07-31-79
NSF Program Manager:
Dr. Raymond J. Hannapel

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

DISSEMINATION OF LOGO-BASED EDUCATIONAL RESEARCH

Dr. Wallace Feurzeig
Bolt, Beranek & Newman, Inc.
Cambridge, Massachusetts 02101

LOGO is an interactive computer language especially designed for education. It was developed by BBN under contract with NSF. It is currently used at forty research and teaching centers. The proposed activity has several purposes. First, in conjunction with the user community, the existing language will be augmented. Second, in order to facilitate easy exchange of programs, the language will be standardized. Third, since a major deterrent to the widespread use of the language is that it requires a large machine, modifications will be made to implement LOGO on a variety of small computers. Fourth, a tutorial guidebook will be developed to assist educators to implement LOGO. Finally, a working meeting will be held to revise the guidebook on the basis of experience. The meeting will also be used to organize a users' group. All LOGO materials will be made available through the National Technical Information Service (NTIS).

Development in Science Education
SED76-11981
$136,912
Award date: 04-01-77
Termination: 08-15-79
NSF Program Manager:
  Dr. Andrew R. Molnar

NATIONAL SCIENCE FOUNDATION
WASHINGTON D.C. 20550

ACTIVITY-BASED EDUCATION PROGRAMS FOR SMALL- AND MEDIUM-SIZE PLANETARIUMS

Dr. Robert Karplus
Lawrence Hall of Science
University of California
Berkeley, California 94720

The United States has 1,100 small- and medium-size planetariums, each seating 20-100 people. They reach approximately 4 million school children and adults each year, predominantly through one-hour single-visit programs. Essentially all planetariums, regardless of size, use the same illustrated lecture format of presentation.

To improve the range of educational opportunities at small- and medium-size planetariums, the project will develop materials to introduce planetarium educators to new techniques for audience participation activities and verbal interaction. A survey in 1976 found that many planetarium educators feel a strong need to learn more of this technique.

The project will design and evaluate two model single-visit activity programs, suitable for any planetarium, and a workshop to present to planetarium educators the theory and practice behind activity-based planetarium learning experiences. Trial workshops will improve the materials and prepare the participants to offer their own local self-supporting dissemination projects using the materials.

Finally, the materials will be made generally available, and the resulting increase in activity learning in the nation's planetariums will be determined.

Development in Science Education
SED77-18387
$105,474
Award: 09-29-77
Termination: 04-30-80
NSF Program Manager:
Dr. Linda Kahan

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

DEVELOPMENT OF PILOT ASTRONOMY ACTIVITIES FOR INFORMAL LEARNING

Dr. Robert Karplus
University of California, Berkeley
Berkeley, California 94720

This is a project to develop and evaluate a pilot set of instructional materials which can be used to teach astronomy in informal group settings. This initial effort is to produce eight to twelve half-hour prototype activities appropriate to persons over ten years old, self-contained, inexpensive, linkable to other activities in the series, teachable by an amateur instructor with only minimal formal science training, and emphasizing the process of scientific investigation.

Development in Science Education
SED77-18818
$80,700
Award Date: 09-15-77
Termination: 09-30-79
NSF Program Manager:
Dr. Linda Kahan

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON D.C. 20550

OUTDOOR BIOLOGY INSTRUCTIONAL STRATEGIES (OBIS)

Dr. Watson M. Laetsch
University of California
- Berkeley
Berkeley, California 94720

The Outdoor Biology Instructional Strategies project (OBIS) is developing new instructional materials and strategies for outdoor biological education (an ecological approach) to be used by youths 10-15 years old for field study. OBIS is directed at the Lawrence Hall of Science by Dr. Watson Laetsch, with Co-Directors Drs. Herbert Thier and Robert Knott. Since the large majority of people live largely in managed environments, OBIS is developing strategies for instruction in specific managed environments. OBIS is currently incorporating materials into a flexible "Folio" format providing maximum opportunity for leader-participant choice and sequencing of activities to conform to personal interests, local environmental problems, and available study sites. The Project will continue its focus on habitats altered by human activity such as the common lawn and the estuary/reservoir environment. Using an ecosystems analysis approach that accounts for the balance between producers, consumers, and decomposers and their interaction in a given habitat, the OBIS materials are intended to be easily adaptable to local conditions anywhere in the U.S. and to introduce concepts of ecology in ways that are attractive to youngsters. The use of OBIS materials in schools, as well as in community-based situations, will be examined.

Development in Science Education
SED72-05823
$919,400
Award date: 05/10/72
Termination: 05/31/79
NSF Program Manager:
Dr. Raymond J. Hannapel

12/1978

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WASHINGTON, D.C. 20550

AN URBAN EXTENSION SERVICE MODEL

3

Perry Shapiro
University of California, Santa Barbara
Santa Barbara, California 93106

The overall program is designed to serve as a model for an Urban Extension Service, patterned somewhat after the U.S. Agricultural Extension Service. The initial project, which was funded for $75,000 for two years, was developed for an alternative master's degree in economics which encompasses three on-campus academic quarters, with core courses in economic theory, six months of supervised intern training in a relevant public service activity paid by county or city governments, followed by a final quarter on campus to relate the field training to academic study. A master's paper on a problem concerning the internship completes the requirement for the degree. This aspect will be continued in cooperation with the Department of Political Science. The university is now ready to implement the second continuing education phases of the Urban Extension Service with two activities, an Extended Degree program in economics and "informal education." The extended degree has already been approved for the Department of Economics and is ready for initiation and preparation of audiovisual instructional modules, and adding several new courses, including one relating to economic analysis as related to political implementation. The instruction will be entirely off-campus, using self-paced instructional materials and AV technology as the mode of presentation. The "informal education" is patterned after Agricultural Extension Service community activities whereby the community member attends lectures, short courses, involves the university staff in the solution of his government problems, and seeks advice from university faculty by letter or telephone. Evaluation and dissemination procedures for the concepts and materials developed are described.

Development in Science Education
SED73-10322
$340,000
Award date: 11/15/72
Termination: 10/31/79
NSF Program Manager:
Dr. Gene D'Amour

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON D C 20550

INTERDISCIPLINARY MASTER'S PROGRAM IN BUILDING STUDIES

Dr. Volker H. Hartkopf
Carnegie-Mellon University
Pittsburgh, Pennsylvania 15213

The program is designed to train broadly-based professionals for a Master's degree in Building Studies. It is expected that the graduates can effectively plan, design, construct, and manage the built environment and be able to handle the many new problems, as well as the more traditional ones. New aspects of the built environment include privacy, defensibility, diversity, and ready access; the older ones are marketability, maintenance, operations, and aesthetic appeal. Greater labor costs, changing technology, increase in building industrialization, and more government regulatory activities all have created new contexts in building design and management. To meet these challenges, the Departments of Civil Engineering and of Architecture and the School of Urban and Public Affairs will jointly initiate an interdisciplinary systems approach, and will develop new courses and prepare basic modular training materials, probably by CAI or slide-audiocassette techniques. An outside advisory committee with members selected on a national basis will be formed to identify wide-ranging problems and approaches in the training so that the project can have the greatest impact on other schools of the nation.

Development in Science Education
SED74-23282
$457,430
Award: 04-28-75
Termination: 09-30-79
NSF Program Manager:
Dr. Linda Kahan

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

SECONDARY COURSE IN APPLICATIONS OF MATHEMATICS TO SCIENCE

Dr. Madeline P. Goodstein
Central Connecticut State College
1615 Stanley Street
New Britain, Connecticut 06050

To help prepare students for the study of the quantitative aspects of secondary science, an area often difficult for them, a curriculum on basic ways in which mathematics is applied to the secondary quantitative sciences is being designed, tested, and evaluated in an experimental course at the Foran High School, Milford, Connecticut, on a small scale in a two-year program. An experimental group of about eighty students study, with frequent use of concrete exemplars, the ways in which natural variables can be related through ratios, direct and inverse relations and proportions, rates, graphs, and dimensional analysis. The course is being taught as a science course by science teachers in the Spring semester of the academic year for two hours per week to tenth grade students. The following year, these students and a control group of approximately equal size will take a course in chemistry. The achievement of the experimental and control groups in chemistry will be compared to determine the effect of the new curriculum on subsequent achievement in a secondary quantitative science course. If the experimental group shows significant improvement over the control group, the next step will be to apply for a grant to redesign the science-mathematics curriculum and to test it on a wider scale. An Evaluation Advisory Team will control selection and administration of tests and advise and pass on design of the statistical analysis.

Development in Science Education
SED77-18444
$37,200
Award Date: 09-08-77
Termination: 03-31-80
NSF Program Manager:
Dr. Linda Kahan

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

SURVEY OF RECENT EAST EUROPEAN LITERATURE IN SCHOOL AND COLLEGE MATHEMATICS

Dr. Izaak Wirszup
The University of Chicago
Department of Mathematics
Chicago, Illinois 60637

The "Survey of Recent East European Literature in School and College Mathematics" was initiated in 1956 with a grant from the National Science Foundation. The general aim of the survey is to analyze and provide information on current Soviet and other East European mathematical literature and mathematics education, and to make available to American researchers, educators, and students, some of the best materials from these sources. To realize these goals the Survey is continuing to publish, on a reduced scale, translated and adapted exceptional expositions for teacher training programs, the new school mathematics curriculum, extracurricular school mathematics, and special secondary schools for mathematically gifted students. It is proceeding further with the publication of its series of translations of selected papers and monographs on Soviet research and psychology and the methods of learning and teaching mathematics. The Survey is expanding its information and publishing activities to cover alternatives in Soviet education--in particular, the curricula and educational literature in newly developed training programs for middle- and higher-level specialists in the computer and information sciences, in cybernetics, and in other applied mathematics disciplines. Finally, it will develop a program on the achievements in mathematics education in the more advanced of the other East European countries.

Development in Science Education
SED76-80599
$271,200
Award Date: 09-30-76
Termination: 03-31-80
NSF Program Manager:
  Dr. Ruth E. Von Blum

12/1978

CAREER-ORIENTED DEGREE PROGRAMS IN THE MATHEMATICAL SCIENCES WITH EMPHASIS ON PRACTICAL EXPERIENCE

Dr. Jerome Spanier
Claremont University Center
Claremont, California 91711

This project is to develop a 5-year degree program in applied mathematics for the training of M.A. level students for careers in industry, business, or government. An essential component of the program is a Mathematics Clinic through which research projects are undertaken by contract with outside organizations and where students, working under faculty supervision, are responsible for the execution of the contract. A course now under development in Mathematical Modeling and Simulation is geared to the formulation, analysis, and evaluation of mathematical models desired for solving practical problems. Both the Modeling course and a Mathematics Clinic Handbook are to be distributed at a national conference on completion of the project.

Development in Science Education
SED76-83365
$214,700
Award: 03-25-77
Termination: 04-30-80
NSF Program Manager:
Dr. Dorothy K. Deringer

AN ALTERNATIVE IN HIGHER EDUCATION IN THE MATHEMATICAL SCIENCES

Dr. Clayton V. Aucoin
Clemson University
Clemson, South Carolina 29631

Clemson University will initiate a three-year project to be coordinated with a similar project at Washington State University, to develop an alternative doctoral program for mathematicians contemplating careers in business, industry, and government. Graduates will not only be prepared in core mathematics, but will have expertise in dealing with technical problems arising outside of mathematics. Distinctive features of the program include training in a nonmathematical option, interdisciplinary courses, and courses where emphasis is placed on active involvement in mathematical modeling; on-campus and off-campus salaried internships; and doctoral dissertations showing research competence with problems in which mathematics is applied to significant "real world" problems. Special emphasis is on development of a series of interdisciplinary models courses.

Development in Science Education
SED75-16576
$173,860
Award: 06-25-75
Termination: 11-30-79
NSF Program Manager:
Dr. Linda Kahan

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

LEARNER-CONTROLLED INSTRUCTIONAL STRATEGIES: AN EMPIRICAL INVESTIGATION

Dr. M. David Merrill
Courseware, Inc.
9820 Willow Creek Road
San Diego, California 92131

The prime goal of this investigation is to empirically validate generalizable procedures for promoting effective "learner control" in computer-based instructional systems. A learner has acquired optimal learner control when he or she can manipulate an instructional environment in such a way that each subsequent instructional display is maximally effective for the particular momentary aptitude state. First, an experiment has been designed to determine which of several strategy controls best facilitates student performance while learning to program a computer programming language (APL). A second experiment is designed to determine if a student in a learner control environment will transfer the strategy learned to other instructional situations. A third experiment is designed to explore the possible use of learner control principles in non-computer-based instruction systems such as audio supported workbooks.

Development in Science Education
SED76-01650
$207,750
Award date: 02-16-77
Termination: 02-28-79
NSF Program Manager:
Dr. Andrew R. Molner

12/1978

XPRT
EXPERIENTIAL PARTNERSHIP FOR THE REORIENTATION OF TEACHING

Richard E. Woodring
Drexel University
Center for Teaching Innovation
Philadelphia, Pennsylvania 19104

The basic goals of the four-year XPRT project are to introduce and expand the use of individualized instruction in existing, traditional curricula at Drexel University and at other colleges that, taken individually, are without sufficient resources to promote large-scale programs of educational reform. This exposure to individualized instruction should provide the means and the incentive for further expansion of these methods, and eventually lead to significant changes in curricula at these schools. Drexel University and its partner schools will thereby progress from their current state, which is partly characterized by traditional curricula using traditional methods of instruction, to a new state which will be characterized by innovative curricula using innovative methods of instruction. It is reasonable to expect that this final state will provide a cost-effective education with improved student achievement levels and increased flexibility in curricula planning.

Thus, development of: (1) curricula relevant to modern engineering problems, (2) improved problem solving skills, (3) improved communication skills, and (4) students who become "lifetime learners" are essential goals of this project. The partnership will provide good quality, widely disseminated materials for pre-engineering subjects which have been carefully evaluated.

Methods by which the XPRT project will achieve these goals in a 3-step process are described whereby several proven individualized instructional course formats are developed at Drexel University. Then, as a 2nd step, faculty from partner schools will be educated in the methods and materials used by Drexel faculty and at the same time modify them for their own use at a summer workshop. The 3rd step will have these faculty returning to their schools to implement these techniques in courses similar to those for which materials have been developed at Drexel.

Development in Science Education
SED75-09198
$625,000
Award date: 05/22/75
Termination: 06/30/79
NSF Program Manager:
Dr. Gene D'Amour

12/1978

A COMPUTER CONFERENCING SYSTEM FOR PEER EVALUATION AND COMMENTARY ON ESSAY TESTS

Dr. Jerome H. Woolpy
Earlham College
Richmond, Indiana 47374

A major aspect of the learning process involves a student's confronting some problem and generating his own answer to it for critique and commentary. This may occur as an experiment is run and a report is submitted, or as a particular body of information is examined to produce some new synthesis of the literature or theoretical statement. It is by this process that the student goes beyond the mere recognition knowledge of material in his discipline to produce some statement of his own which can be examined by his mentor. There are problems, however, in carrying out this type of education. While it is commonplace in the apprenticeship type of relation in graduate school and may occur in independent studies and small seminars at the undergraduate level, this approach to instruction becomes logistically impractical in large classes. The proposed computer system will organize the students in large courses into three types of activities: 1) question generating, 2) answering, and 3) commentary on answers to provide for the kinds of constructed solutions to problems and cross-critique which are available in small seminars. This project will examine how closely computer conferencing techniques can approximate the seminar in terms of dialog and cross-critique. Although the approach may be useful in many scientific areas, it will be tested in biology and operations research. To facilitate transferability, the system will be written in standard FORTRAN and documented according to CONDUIT standards.

Development in Science Education
SED77-18890
$124,800
Award: 09-21-77
Termination: 02-29-80
NSF Program Manager:
  Dr. Dorothy K. Deringer

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

INSTRUCTIONAL MODULES IN APPLIED MATHEMATICS IN HIGHER EDUCATION (UMAP)

Dr. Ross L. Finney
Education Development Center, Inc.
Newton, Massachusetts 02160

Instructional materials in modular format (modules) will be written for college students enrolled in science and engineering courses or in mathematics courses that function as service courses for students majoring in science or engineering disciplines. These modules will be produced in a common format that is increasingly familiar to various institutions and disciplines, and they will be largely independent of each other; therefore barriers to their adoption at colleges throughout the nation should be low. The content will range over all the topics in mathematics needed by students in the various physical, biological, environmental, social, and engineering fields, and will be determined by task forces that include representatives from these fields. The modules will emphasize the application of mathematics to research and development problems in these fields.

A major goal of the project is the organization of a consortium of producers and users. Any college or university may join the consortium and appoint a representative to a governing council. The Council will include the members of a Steering Committee that already oversees the activities of Project CALC, an earlier project involving the same site and principal staff members. The Council, assisted by its Executive Board, will set policies and priorities for the task forces and the project staff. The existence of the Consortium should help to promote the input of materials from creative producers and the testing and adoption of materials at the member institutions.

Development in Science Education
SED76-19615
$1,143,580
Award: 06-28-76
Termination: 12-31-80
NSF Program Manager:
  Dr. Dorothy K. Deringer

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

ADMINISTRATIVE ACTIVITIES RELATED TO NSF-SUPPORTED CURRICULUM MATERIALS

Dr. Jerry D. Murphy
Education Development Center
Newton, MA 02101

The distribution of more than 100 titles of text materials and over 600 films developed by EDC with NSF funding will be administered and managed. NSF-imposed accounting activities will be followed and appropriate reporting procedures carried out, for example, with respect to royalty-income. Categories of support include (1) contract and publication administration, and (2) administration of film materials.

Development in Science Education
SED78-20121
$81,438
Award Date: 10-19-78
Termination: 09-30-79
NSF Program Manager:
Dr. Linda Kahan

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

QUANTITATIVE UNDERSTANDING TO ENHANCE SOCIAL SCIENCE TEACHING

Irving Morrissett
Educational Resources Center, Inc.
Boulder, Colorado 80302

This is a project to create 30-50 curriculum modules which can be infused into current secondary school social science programs to introduce and develop skills and understandings in the application of quantitative techniques to social issues and problems.

During the first phase of the project, project staffing was completed and a consultant panel of ten social scientists was selected. The major activity during this initial phase was an extensive search for background information related to quantitative methods in social science. An inventory of quantitative concepts and skills used in social science was constructed with the assistance of the consultants, and from this an inventory of concepts and skills to be developed in the project were selected by the Staff. Outlines for nearly 20 specific modules were developed; 10-12 modules will have been pilot tested in schools by June 1978.

During the second phase, the 10-12 modules tested in Phase I will be revised, 24-26 additional modules will be developed (total 36). National field testing of the 36 modules and finally dissemination of results and materials will follow.

Development in Science Education
SED77-18598
$223,958
Award date: 09/28/77
Termination: 04/30/80
NSF Program Manager:
Dr. Gene D'Amour

12/1978

INDIVIDUALIZED SCIENCE INSTRUCTIONAL SYSTEM

Dr. Ernest Burkman
Florida State University
Tallahassee, Florida 32306

The Individualized Science Instructional System Project (ISIS) is focused on the development of a flexible, interdisciplinary curriculum to provide science instruction relevant to the individual needs and abilities of a spectrum of high school students, particularly those not especially apt at science and/or those who do not intend to go on to college science studies. ISIS will consist of approximately 30 short, essentially independent minicourses, each requiring 2-3 weeks of classroom time, plus resource materials and student and teacher handbooks. Each minicourse will deal with a specific topic by presenting the appropriate mixture of concepts and skills from biology, chemistry, physics, mathematics and the social sciences. When complete, the system will permit construction of full year ISIS courses in General Science, Physical Science and Biological Science from selected sequences of ISIS minicourses.

Materials in trial form have been field tested by more than 10,000 high school students in selected schools across the country. Separate content reviews are carried out on each minicourse. Twenty-one minicourses are currently commercially available from Ginn and Co.

During final phase of this award, the project will complete testing and revision and preparation of camera-ready copy for the final nine minicourses. The student and teacher handbooks will be completed for publication.

Development in Science Education
SED77-22653
$1,468,711
Award Date: 08-31-77
Termination Date: 03-31-80
NSF Program Manager:
Dr. Linda Kahan

DEVELOPMENT OF AN INTERACTIVE CONVERSATIONAL COMPUTER MODEL FOR LINEAR PROGRAMMING

Dr. John J. Jarvis
Georgia Institute of Technology
Atlanta, Georgia 30332

This project is designed to respond to the problems encountered by students in the utilization of linear programming as a problem solving tool in a variety of undergraduate science and engineering courses. In order to accomplish this objective, it is proposed that emphasis on its utilization be shifted from model manipulation to bona fide interaction with the computer in a manner that permits comprehension of the small mathematics, management and engineering problems involved. In these various courses, each student is expected to develop modeling skills involving linear programming, comprehend the simplex method (or variants) as a tool for solving and interpreting output on specific problems, and adjusting the model and repeating the process until desirable results are attained. Because of the complexity of this process, the student often encounters a set of unique difficulties that tend to obfuscate the value of the computer as a modeling technique for rapid resolution of the problem involved. As a consequence, a negative response ensues and the problem involved becomes secondary to the manipulations involved. Therefore, it is proposed that a truly conversational linear programming code for use on small problems (E-Z-LP) be further developed and refined for this purpose. The professed key to E-Z-LP is its ease of interaction with the computer without compromising solution of the problem involved.

Development in Science Education
SED75-17476
$50,673
Award Date: 06-10-75
Termination: 03-31-79
NSF Program Manager:
  Dr. Dorothy K. Deringer

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

PSYCHOACOUSTIC DEMONSTRATION TAPES

David M. Green
Harvard University
Cambridge, Massachusetts 02138

The goal of the project is to produce a collection of approximately 20 cassette recordings, each illustrating a fundamental psychoacoustic phenomenon to demonstrate a given point of instructional sequence. It is expected that the major use of the recordings will be in undergraduate and graduate classes on auditory sensation and perception. It is expected that the tapes will be used in approximately 100 undergraduate courses where the topics of sensation and perception are taught and some of them could be used in Introductory Psychology classes. Each tape will be accompanied by a short booklet so that the instructor need not be an expert in the area to fully understand the demonstration and its significance.

Development in Science Education
SED76-24215
$45,800
Award date: 04/06/77
Termination: 04/10/79
NSF Program Manager:
Dr. Gene D'Amour

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

CURRICULUM ANALYSIS, STUDENT INTERROGATION AND INFORMATION SYSTEM

Dr. Ernest J. Henley
College of Engineering
University of Houston
Houston, Texas 77004

The University of Houston is a member of a consortium of institutions, and this project is building on a number of modular course programs to produce a computer-aided modular instruction system which could function across many disciplines and many campuses. By shifting from a curriculum system based on several score of courses to one based on several thousand single-concept modules, the project will explore the opportunities for individualized curriculum planning, empirically based curriculum reorganization, self-study and self-pacing, and improved student motivation and remediation. But coping with thousands of students making individual choices, while respecting tens of thousands of prerequisites which link the units, overwhelms current hand-and-paper registration systems - already strained at large institutions. Thus the project will develop a computer-based information system which will keep up with almost numberless possible independent paths a student might take in achieving his aims, which will provide authors with information on needs for new materials, and will assist professors and curriculum committees in restructuring the curriculum.

The software for the system is organized into relatively free-standing packages to foster transportability to and updating by diverse institutions. Dissemination would be via a self-supporting national users' group to refine and maintain the programming.

Development in Science Education
SED76-21950
$175,960
Award date: 06/01/77
Termination: 10/31/79
NSF Program Manager:
Dr. Gregg Edwards

12/1978

THE DEVELOPMENT OF MODULES FOR THE UNDERGRADUATE CHEMICAL ENGINEERING CURRICULUM AND CONTINUING EDUCATION
(CACHE)

Dr. Ernest J. Henley
College of Engineering
University of Houston
Houston, Texas 77004

This is an extended instructional module development and dissemination project for undergraduate chemical engineering and related areas. It builds on a first-round competition review and publication of 125 instructional units centered on computer-based problems and associated theory. The next step explores a procedure for including primarily noncomputer-based materials chosen to cover the fundamentals of undergraduate instruction in the field. It attempts to set up the system on a self-supporting basis. The specific goals of the project are: 1) Determination of appropriate format and content for undergraduate units; 2) a graph theoretic analysis of the pre-graduate chemical engineering curriculum; 3) procedure for review and evaluation of submitted materials, with multiple levels of "certified" publication; 4) organization of 7 continuing groups to manage the work in the major curriculum areas; 5) eliciting and distributing 500 units covering the core topics of the ChemE curriculum; and 6) exploration of a consortium of departments for continuing support of the operation.

Development in Science Education
SED75-03911
$145,790
Award: 06-25-75
Termination: 05-31-79
NSF Program Manager:
Dr. Gregg Edwards

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

FAMILY-INVOLVING SCIENCE EDUCATION FOR ELEMENTARY SCHOOL CHILDREN

Dr. Michael E. Browne
University of Idaho
Moscow, Idaho 83843

This project will develop and test materials which will form the basis for a family-oriented program of individual science investigations for grades K-8 carried out by children at home. The materials consist of a teacher's resource manual and separate guides for students and for parental or caring adult advisors. The guides cover all fields of science and utilize the inquiry approach. They are modular and self-contained in form and may readily be used in conjunction with other curricula. The materials are used in the following way: With reference to the teacher's manual the teacher invites interested pupils to participate in a program of scientific research. An evening workshop is held once each month with parents or other caring adults, at which time the teacher outlines the nature of the studies to be made. The caring adult or parent runs through the experiments and receives explanations of the phenomena. He or she receives an "Advisor's Guide" which will help in the supervision of the work to be done at home by the child. Children receive separate guides suggesting topics for investigation. These guides pose challenging questions and indicate possible avenues to pursue. Students keep individual journals and report in class on their results. The monthly meetings with parents or caring adults strengthen adult-school bonds and develop a good academic home atmosphere. The meetings also constitute effective continuing adult education.

The influence of the family on school achievement is well recognized, and this project plans to utilize the family as a major resource in the learning process.

Development in Science Education
SED77-18034
$75,500
Award date: 09/16/77
Termination: 01/31/81
NSF Program Manager:
  Mr. Bill G. Aldridge

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

DEMO-GRAPHICS: TEACHING POPULATION DYNAMICS IN A MULTIDISCIPLINARY FRAMEWORK WITH INTERACTIVE VISUAL GRAPHICS

Dr. Paul Handler
University of Illinois
Urbana, Illinois 61801

The Population Dynamics Group (PDG) will utilize currently available computer technology and population programs as the basis for development of instructional materials on population dynamics and population-related issues. The work accomplished on the project is threefold: 1) Development of ten written modules on such subjects as the relationship between population and food, energy, economic development, and requirements for educational facilities. The multi-purpose modules are designed to be integrated into a variety of courses in several science disciplines and will serve a number of teaching situations at the undergraduate and graduate levels. They are accompanied by student guides with problem lists and bibliography and instructor guides. 2) Conversion of the computer graphics resource materials on population dynamics, already available on the PLATO computer system and developed under an AID grant, to other computer systems via paper tapes, magnetic tapes, or IBM cards as appropriate to the facility available to the user school, to be accompanied by a technical manual on the conversion process. 3) Dissemination of the printed and computer graphics material nationally via workshops, newsletter, personal contact, and a textbook.

During the first two years of the project, the necessary modules on demographics were written and converted so as to operate on a variety of computer systems. About 100 institutions received tapes containing the modules: some 3,000 students are using the lessons. Several workshops have been held concerning the project: they have been well attended and satisfying. During the final year (1978-79), the emphasis is shifted to shortening some modules (to make them more widely useful) and evaluating the effects of the modules. Dissemination activities will, of course, continue.

Development in Science Education
SED76-18446
$316,799
Award Date: 06-30-76
Termination: 01-31-80
NSF Program Manager:
Dr. Gregg Edwards

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

CONDUIT: CONSORTIUM FOR THE DISSEMINATION OF COMPUTER-BASED CURRICULAR MATERIALS

Dr. James W. Johnson
University of Iowa
Iowa City, Iowa 52240

CONDUIT is a consortium of over 300 colleges and universities devoted to developing procedures, systems and techniques to facilitate the transfer and sharing of computer-based instructional materials in science education. CONDUIT tests, evaluates, certifies and disseminates available computer-based materials in chemistry, physics, economics, biology, mathematics, sociology, psychology, political science and geography. CONDUIT provides information about the use of computers through "state-of-the-art" reports, the CONDUIT PIPELINE and CONDUIT catalog and compendium.

During 1975-76 twenty-five packages of materials with over 680 programs were reviewed and tested. CONDUIT has disseminated approximately 500 packages of materials to over 100 institutions. Since then, they have been engaged in:

(1) reviewing and recommending 60 new packages of materials,
(2) providing instructors with current information about computing in their disciplines,
(3) developing instruments, procedures and standards to facilitate the transfer of materials,
(4) assisting developers in producing complete high quality, transferable materials.

Development in Science Education
SED75-06596
$1,091,850
Award date: 06-23-75
Termination: 06-30-79
NSF Program Manager:
Dr. Andrew R. Molnar

12/1978

COMPUTER-ASSISTED DATA ANALYSIS

Dr. Melvin R. Novick
University of Iowa
Iowa City, Iowa 52242

The Computer-Assisted Data Analysis (CADA) Monitor is a set of conversational-language interactive computer programs designed to aid both in the teaching of data analytic techniques and in the carrying out of analyses of real data. It is written in BASIC and has been translated into BASIC dialects for several different computing systems, including two microprocessor-based systems. New versions of the system are released annually. For relatively inexperienced persons, CADA provides the direction necessary to learn to correctly apply sophisticated statistical techniques; for the experienced user CADA provides the flexibility needed for a thorough analysis.

The final phase of this grant will facilitate the fulfillment of the remaining original research goals of the project: the providing of a Bayesian analysis for non-conjugate prior distributions; the development of extensive utility elicitation and statistical decision theoretic components; the development of a general Bayesian linear component model; the exploration of CADA as a primary computing tool of a university statistical consulting center; the formation of a CADA users' group; a CADA users' training session; and the continuing translation of CADA into major BASIC systems.

Development in Science Education
SED77-18432
$188,400
Award: 09-07-77
Termination: 06-30-80
NSF Program Manager:
Dr. Dorothy K. Deringer

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

DEVELOPING SCIENCE CURRICULUM UNITS USING THE TEAMS-GAMES-TOURNAMENTS INSTRUCTIONAL PROCESS

Dr. John H. Hollifield
Center for Social Org. of Schools
The Johns Hopkins University
Charles & 34th Streets
Baltimore, Maryland 21218

The Teams-Games-Tournament (TGT) instructional process uses teams and games in the classroom to increase student learning of basic skills and information. The process has been shown to have positive effects on student learning in math and language arts, and TGT units for these subjects have been developed and disseminated. The objective of this project is to develop TGT instructional materials for junior high science units to help students acquire a firm science knowledge base thus motivating more students to continue studies in science.

The activities of the project include: (1) identifying units of junior high science appropriate for teaching by TGT, (2) specifying learning objectives of the units, (3) writing TGT worksheet and game items for each objective, (4) pilot testing worksheets and games, (5) revising items and objectives based on pilot results, (6) field testing revised units, (7) making final revisions, and (8) disseminating through commercial publication.

The materials produced will cover various science units (astronomy, biology, geology, energy) depending on their appropriateness for teaching with TGT. Each developed unit will contain approximately five generic objectives, 25 specific objectives, and 25 worksheets and gamesets.

Development in Science Education
SED77-19102
$168,000
Award date: 09/19/77
Termination: 02/29/80
NSF Program Manager:
Dr. Ruth E. Von Blum

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

DEVELOPMENT OF A GENERAL ENGINEERING TECHNICIAN CURRICULUM

Donald R. Mowery
Junior College District
of St. Louis
St. Louis, Missouri 63110

The goals of this project are:

1. Design a curriculum for preparation of general engineering technicians in a two-year, associate degree program;

2. Provide trial implementation of the curriculum and course materials for revisions;

3. Implement the curriculum so that graduates could serve as technicians in a wide range of specialties, transfer to four-year programs with a minimum of disruption, and easily adapt to changes in industry and technology after graduation.

The project during the past three years has prepared drafts of 12 of the projected 15 study guides (100 page discussions presenting the heart of a course) and has been adopted in trial at seven colleges. Five further colleges have applied to be field test centers during the coming year.

This final phase will concentrate on revision and completion of the course materials after field testing, and on documenting ways to facilitate the adoption of the curriculum by other schools.

Development in Science Education
SED77-17935
$70,400
Award date: 09/28/77
Termination: 05/31/79
NSF Program Manager:
Dr. Gene D'Amour

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

EDUCATIONAL MODULES DEVELOPMENT FOR THE NUCLEAR FUEL CYCLE

Dr. N. Dean Eckoff
Kansas State University
Manhattan, Kansas 66506

The purpose of this project is to develop, through a national committee with university and industrial representatives, a series of educational modules to improve instruction concepts of the nuclear fuel cycle (NFC). This is an area of ever-increasing demand for manpower and technical knowledge; at present there are inadequate instructional materials and the present system for providing materials cannot keep up with the changes. This project sets up a national committee to encourage the development and exchange of materials on the most important topics. Five goals are identified: 1/ To survey current programs and materials. 2/ To establish task forces which will be charged with developing appropriate modular materials for the various nuclear fuel cycle steps. Some of the teaching modules are autotutorial or individually prescribed instruction. They involve the use of computer programs where appropriate, visual aids, and in some cases, audio aids. 3/ To develop materials in four areas not covered by specific task forces. 4/ To develop materials covering current government and industry policies as well as the legal aspects of the nuclear fuel cycle. 5/ To establish a permanent committee under the auspices of a professional organization such as the American Nuclear Society to carry on with this activity.

Development in Science Education
SED75-04822
$140,000
Award: 06-20-75
Termination: 09-30-79
NSF Program Manager:
Dr. Gregg Edwards

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

EDUCATIONAL COMPUTER-BASED MODELS FOR SOCIO-ECONOMIC-TECHNOLOGICAL SITUATIONS
(E-COMSETS)

Dr. William E. Schiesser
Lehigh University
Bethlehem, Pennsylvania 18105

The overall objective of the program is to encourage the use of computer-based modeling and simulation higher education, particularly in those fields which have traditionally been nonquantitative, by the development and dissemination of a series of mathematical models and associated programs for student analysis of contemporary socio-economic-technological problems. Particular attention will be paid in the development of the materials to standardization, quality, and ease of use.

In the first Phase, computer models were developed by eight faculty participants (7 from Lehigh and 1 from Bucknell) who cooperated to share background knowledge and a common methodology for mathematical modeling and computer simulation. In the next Phase, computer programs are being written in a standard format and computer language so that they will be transportable between computers. Computer programs (in machine-readable form, with supporting documentation including an introductory programming manual) will be made available by mail to interested educators for a nominal preparation charge. Training sessions, given by a Lehigh faculty group, will present in detail to the faculty of other institutions the underlying mathematics and computer methodologies in order to foster effective use of the materials. The activity will be evaluated by content-centered peer groups at Lehigh, by a group of specialists at Lehigh experienced in evaluation techniques and cost analyses, and by a national advisory committee.

Development in Science Education
SED77-14880
$339,600
Award Date: 09-16-77
Termination: 02-28-81
NSF Program Manager:
Dr. Linda Kahan

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

CONVERSION OF TEXT TO SPEECH FOR COMPUTER-AIDED INSTRUCTION

Dr. Jonathan Allen
Massachusetts Institute of Technology
Cambridge, Massachusetts 02139

This project is directed to what is considered to be a serious problem by developers and users of computer-based learning systems--the delivery of good-quality synthetic speech. The system will convert unrestricted English text input to digitally-stored speech which can then be output as natural-sounding messages.

The first grant (FY75) to the principal investigator, Professor Jonathan Allen, was to produce a research prototype of the system. The two-phase final grant is to produce a complete set of algorithms to convert text to speech, special hardware to synthesize speech at the terminal and a system framework which facilitates modular improvements. The final objective is to produce an engineering prototype of the system that will be optimized for performance under field conditions.

Work during the first phase has included conversion of the system to two new computer systems (DECSYSTEM-20 and PDP-11/60), improvement of the pitch and timing algorithms and developing an implementation of the system in both software and hardware that will be useful in computer-based learning systems. The second phase will continue progress toward the production of high quality speech and an implementation of the system that can be used practically in CAI systems.

Portions of Allen's current system have been transported to Professor Patrick Suppes' project at the Stanford Institute of Mathematical Studies in the Social Sciences (IMSSS). One of the continuing interests at IMSSS is the use of voice output in the CAI environment. Allen's work has also been transported to Telesensory Systems, Inc., which has an NSF grant to simulate a reading machine for the blind. To further enhance transferability a one-week summer course will be offered in June 1979.

Development in Science Education
SED76-81985
$464,600
Award: 08-01-77
Termination: 12-31-79
NSF Program Manager:
  Dr. Dorothy K. Deringer

A MODEL PROGRAM FOR CONTINUING EDUCATION IN CHEMICAL ENGINEERING

Dr. Karen C. Cohen
Massachusetts Institute of Technology
Cambridge, Massachusetts 02139

This project's first phase was to explore a self-sustaining, cost-effective program for practicing engineers to: update their skills; attain advanced degree levels of professional maturity; and modify their career especially in middle years. This was to be done via an academic-industry-professional society consortium for: development and exchange of instructional materials; delivery of problem-centered, individualized education, and certification of skills and levels of competency. Its features would be: 1)Modularity-- Activities and subject units structured for clear interrelations and easy local adaptation. 2)Multi-scale certification-- For each small topic assessment of person's knowledge and skills, and, separately, levels of competency and problem solving. 3)Individualized-- Low costs so individuals can pay own fare. Diagnostics for self-management of instruction. 4)National system-- The main institutional actors will help in design system and set up an internal credits/debits for self-support. 5)Problem-centered-- Peer teams, case-studies, workshops for active competencies built on self-paced units. 6)Multi-disciplinary-- Content was in application areas chosen for impact on national needs. The results expected are: a working consortium; two prototype programs, one energy-related in trial; the major components detailed so that they may be used by other projects--retrieval and accessing systems to handle large numbers of modules and students, diagnostics for self use, assessment of levels of competencies, and procedures for revising modularized adaptive materials.

Development in Science Education
SED74-20092
$772,530
Award: 06-30-75
Termination: 05-31-79
NSF Program Manager:
Dr. Gregg Edwards

12/1978

INSTRUCTION MATERIALS AND DELIVERY SYSTEMS FOR AN UNDERGRADUATE CURRICULUM IN PEST MANAGEMENT FOR PLANT PROTECTION

Dr. D. L. Armstrong
Dr. Fred H. Tschirley
Michigan State University
East Lansing, Michigan 48823

Public and professional re-evaluations of pest control practices during the past 20 years have led to major changes in legislation associated with pest control. These changes require the services of professional personnel trained in modern concepts of pest management, although curricula providing such training are either absent or inadequate at most universities. To ensure the development of such training that will be useful to future employers and for adoption by other universities, the Michigan State University has devised a curriculum divided roughly into three groups and which includes 1) a new introductory pest management course; 2) five pest-oriented existing courses; and 3) a series of three new final integrating courses based on systems analysis. Included are a field practicum and an optional internship in agricultural service or industrial employment. The developed curriculum will be tested at the University and four other academic schools, including an "1890" school. Distribution of the materials will be through publishers of instructional materials, and the use of their distribution systems.

Development in Science Education
SED75-20185
$299,810
Award date: 06/19/75
Termination: 11/30/79
NSF Program Manager:
  Dr. Gregg Edwards

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

PROBLEM-ORIENTED PHYSICS INSTRUCTION

Dr. Peter Signell
Michigan State University
East Lansing, Michigan 48824

This project has been exploring the potentialities of developing new instructional approaches in physics, and appropriate and cost-effective means for their production and distribution. The goal of current work is to complete the products and documentation of the research. Approximately 25 instructional modules will be completed; they focus on a problem-solving approach and especially on techniques and skills which are used in solving physics problems in a number of different areas. A number of them introduce basic ideas of physics in the context of current citizen concerns such as solar energy, noise abatement, and effects of radioactivity. Considerable experimentation has gone on in establishing formats which foster adaptability to many different kinds of instruction, including traditional classroom work as well as self-study or self-pacing; the results are being documented in a guide to authors and module-developers. Several modes of production are being explored, including small honoraria and open competitions, volunteer development, review and revision, and cooperative dissemination; the results are being written up. Surveys of appropriate literatures on printing standards, retrieval thesauruses, and a computerized Module Band information service for authors are nearing completion.

Development in Science Education
SED74-20088
$364,430
Award date: 06/19/75
Termination: 02/28/79
NSF Program Manager:
Dr. Gregg Edwards

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

CURRICULAR MATERIALS IN COMPUTER-AIDED SHIP DESIGN

Dr. John Woodward
The University of Michigan
Department of Naval Architecture
Ann Arbor, Michigan 48109

A computer system has been developed in cooperation with the Massachusetts Institute of Technology to serve as a tool in teaching ship design to undergraduate students. It will eventually consist of a library of computational modules, an executive program to aid the student in using these modules, supervisory modules, measure of merit modules, and data banks. It is intended to increase the student's learning by increasing the range of alternatives that can be explored by making easy the repeated application of measures of merit when design decisions are to be made.

The executive program called DEX has been developed and installed in The University of Michigan and several computational modules have been developed. This proposal will provide for further development of the design modules, develop a methodology of use, and assist with the transfer of these materials to other institutions.

Development in Science Education
SED76-08438
$471,380
Award: 03-08-74
Termination: 06-30-79
NSF Program Manager:
Dr. Gregg Edwards

12/1978

HIGH SCHOOL MINICOURSE ON CHRONOBIOLOGY

Dr. Franz Halberg
University of Minnesota
Minneapolis, Minnesota 55455

The project would develop, test, and disseminate a two- to four-week minicourse for high school biology courses that will include conceptual tools for identifying and describing rhythms, laboratory exercises with plants and animals, and examples of applications in ecology, agriculture and health sciences, including nutrition, occupational safety, and education. Course materials will include a text of about 60-100 pages, student instructions for laboratory experiments and field activities with optional extensions, tests, and a teacher guide that provides background readings, suggestions for laboratory and field demonstrations, audio-visual presentations, and coordination of these varied components. Content will be validated with national experts through the International Society for Chronobiology. Materials will be piloted and revised with a few experienced teachers in one or two classes in the spring of the first year. Selected local teachers will use the revised materials during the third six-month period. The result will be a coherent teachable package.

Development in Science Education
SED77-18794
$90,000
Award date: 09/07/77
Termination: 08/31/79
NSF Program Manager:
Bill G. Aldridge

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

DEVELOPMENT OF RESOURCE MATERIAL FOR INSTRUCTION IN USE OF UNDERGROUND SPACE

Dr. Truman Stauffer
Department of Geosciences
University of Missouri, Kansas City
Kansas City, Missouri 64110

There is a definite need for pertinent factual and practical information on the use of the sub-surface. The benefits of sub-surface locations have induced dry and frozen food storage, factories and offices to use underground locations in the Kansas City area. Industry has successfully used mined-out space for over two decades, and the area is a natural laboratory providing on-site learning situations for the study of underground space utilization. A course of study acquaints students, both undergraduate and graduate, with the physical, cultural, social, legal, economic, and health factors inherent in the use of sub-surface space.

A course in the "Occupance and Use of Underground Space" is being given in the Geography Department of the University of Missouri, Kansas City, and it is through this mechanism that the materials are being developed. These will include a source manual that may be used by business and industry, as well as by other universities, slide sets, and a tape library of pertinent discussions. It is anticipated that current knowledge gaps will be filled in and that presently fragmented knowledge will be tied together. The plan is to accumulate existing materials, supplement these materials during the course offerings, select areas where additional study is needed which will be carried on during the summer after each course is given, incorporate selected supplementary materials and summer research into a comprehensive source manual, and then make this material available by publication and distribution.

Development in Science Education
SED76-10100
$83,800
Award date: 02/02/77
Termination: 12/31/79
NSF Program Manager:
Dr. Gregg Edwards

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

INVENTORY OF COMPUTING ACTIVITIES AND RELATED DEGREE PROGRAMS IN U. S. HIGHER EDUCATION

Dr. John W. Hamblen
University of Missouri
Rolla, Missouri 65401

Significant changes have occurred in computer systems technology and use patterns since the two previous surveys (1964-65 and 1969-70) of computing activities in higher education were conducted. Therefore, a third National Inventory of Computers in U. S. Higher Education will be made to collect data to provide planners and administrators with accurate, up-to-date data on computing activities in academic administration, research and instruction. The final report will consist of two volumes. The first will be a publication of the tabulations and extrapolations of data similar to the earlier surveys. The second volume will consist of interpretative reports on the status of academic computing by selected experts.

Development in Science Education
SED75-17157
$213,300
Award date: 05/22/75
Termination: 08/31/79
NSF Program Manager:
Dr. Andrew R. Molnar

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

SELF-PACED TUTORIAL COURSES FOR MINERAL SCIENCE-METALLURGY DEPARTMENTS

Dr. L. G. Twidwell
Montana College of Mineral
Science and Technology
Butte, Montana 59701

Mineral Science departments (Metallurgy, Mineral Processing) in American colleges and universities face a serious and growing problem in maintaining quality instruction under conditions of limited availability of faculty and small student enrollments. The staff of Montana College of Mineral Science and Technology offers, by developing PSI materials prepared by experts in the field, an alternative to the current and near-future critical teaching problems. Support is provided for the development of an experimental cooperative project by experienced college and industrial personnel to offer an additional teaching option to help alleviate this need. Individual tutorial courses are developed, student-tested, and presented over a three-year period. These courses are at the junior and senior levels and deal with Unit Processes in Extractive Metallurgy, including 1) Hydrometallurgy; 2) Pyrometallurgy; 3) Electrometallurgy; and 4) Rate Phenomena in Process Metallurgy. The coordinators and staff of the courses include faculty from both Montana College and the University of Missouri at Rolla, as well as metallurgists from Anaconda Company, American Metals Climax, Incorporated, and Kennecott Copper Corporation. Plans are given for evaluation of the courses and dissemination of information and results.

Development in Science Education
SED75-04821
$131,115
Award: 06-18-75
Termination: 05-31-79
NSF Program Manager:
Dr. Gregg Edwards

DIAGNOSTIC AND INSTRUCTIONAL SERVICES FOR UNDERGRADUATE STUDENTS OF STATISTICS

Dr. Jerry A. Warren
University of New Hampshire
Durham, New Hampshire 03824

Two systems designed to improve the delivery of instruction in college-level statistics have been developed. A Diagnostic System provides a collection of test questions and a variety of application areas in elementary statistics. A Resource System will provide students and instructors with descriptions of available instructional materials. The Diagnostic System presently contains approximately 1500 items, 1150 with answers. Materials for the Resource System are presently being reviewed. Both diagnostic test items and descriptions of available instructional materials will be coded with statistical terms that will identify parameters, such as topic and level of difficulty, relevant to planning individualized study programs.

Dissemination and testing will take place via summer sessions and observed use of the systems in other schools. These plans include a six-week session this summer at the University of New Hampshire and use of the system at Wright State University in Dayton, Ohio. At the summer session students will be taught by nationally recruited statistics instructors. Guidelines to assist both instructors and students in using these retrieval systems will be prepared under this grant.

Development in Science Education
SED76-12191
$347,500
Award Date: 03-18-77
Termination: 10-31-80
NSF Program Manager:
  Dr. Dorothy K. Deringer

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

DEVELOPMENT OF TEACHING MATERIALS FOR COMPUTER PROGRAMMING

Dr. David L. Parnas
University of North Carolina
at Chapel Hill
Chapel Hill, North Carolina 27514

Professor E. W. Dijkstra has set forth a radical new approach to programming and the teaching of programming. One of the keys to the method is the use of an unusually elegant programming notation that allows algorithms to be constructed free from the arbitrary restrictions imposed by conventional programming languages. The availability of an implementation of this language that is designed for use in teaching is essential to teaching this new programming approach to the undergraduate level. This project will:

(1) Develop a well-engineered teaching tool based on Dijkstra's language.
(2) Develop a course syllabus based on Dijkstra's concepts but designed for undergraduate students.
(3) Teach (on an experimental basis) a course on disciplined programming using this syllabus and the programming tool.
(4) Compare the programming ability and understanding of students taught using the new approach and those taught in our present, more conventional courses.
(5) Make both the teaching/programming tool and the syllabus available to other universities for further testing.

Work during the first phase of the grant has concentrated on designing the Input/Output scheme for the Dijkstra Programming Language (DPL) and on designing the translator. To enhance transferability the compiler will be written in a subset of ANSI Standard FORTRAN and only one module of the compiler will be machine dependent.

Development in Science Education
SED77-18518
$196,700
Award Date: 09-09-77
Termination: 02-28-81
NSF Program Manager:
Dr. Dorothy K. Deringer

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

DEVELOPMENT AND TRIAL OF AN INTEGRATED UNDERGRADUATE SCIENCE MAJOR PROGRAM

Dr. Mark Pinsky
Northwestern University
Evanston, Illinois 60201

The Integrated Science Program involves an accelerated three-year B.A. curriculum focused on mathematics, physics, chemistry, biology geology and astronomy, including theoretical, laboratory, observational and computational training. It is designed for the superior student who will have advanced placement in mathematics. In the fourth year, after receiving the B.A., the student will have the option of 1) taking a dual major; 2) taking a master's degree; or 3) taking additional coursework to prepare for graduate instruction in the chosen field. The graduate will be expected to have a broad understanding of science and experience of a wide range of techniques and materials leading to work more influenced by national societal needs and problem-solving than is often the case with discipline-trained individuals. It is hoped the program will serve as a national prototype and give undergraduates an overview of all the sciences and of mathematics in terms of first principles, the state of the art, and problems at the forefront in science. Information about the program will be published in journals; progress reports will be made via newsletters and technical publications in educational literature; a syllabus of the courses will be made available at no cost.

Development in Science Education
SED76-01243
$418,485
Award Date: 06-25-76
Termination: 05-31-79
NSF Program Manager:
Dr. Linda Kahan

DEVELOPMENT OF A COHERENT SERIES OF PARTICIPATORY EXHIBITS FOR THE PALACE OF ARTS AND SCIENCE FOUNDATION EXPLORATORIUM IN SAN FRANCISCO

Dr. Frank Oppenheimer
Palace of Arts and Science Foundation
San Francisco, California 94123

The project involves the planning, conception, development and fabrication of exhibits that will provide a learning and teaching resource in the physical and life sciences. The objective is a unified and versatile resource that can be used for a wide range of formal and individually managed instruction. There will also be an ongoing evaluation of the effectiveness, durability and breadth of appeal of the exhibits as well as an attempt to disseminate, through the establishment of a model and through publishing material, the underlying pedagogical ideas and the detailed implementation of these ideas. The efforts of the Exploratorium involve an experimental approach as well as combining the experience of other museums, with expertise in teaching practices and curriculum development at many different levels. Past NSF support has resulted in about 250 exhibits. The unique features that the Exploratorium has contributed to exhibit pedagogy will be incorporated in the continuing development. These features include: 1) An underlying emphasis on the phenomena and mechanisms of human sensory perception. 2) An intimate interweaving of the works of artists, scientists and engineers in the exhibit material. 3) An openness of each exhibit that enables different individuals to become involved and inventive at their own level. 4) The selection of exhibits in such a way that they can be used as interwoven threads for a variety of learning in mini-curricula. 5) The presentation of each basic phenomenon in a multiplicity of contexts in order that the visitors can abstract an underlying way of thinking about natural phenomena. 6) A consistent attempt to introduce new exhibit materials only if they are connected by some logical or experiential thread to the other exhibits on display. 7) Development of "recipes" by which educators in other museums can duplicate Exploratorium exhibits in their own institutions. Approximately 100 new exhibits will result from this award.

Development in Science Education
SED72-05822
$1,046,984
Award date: 04/20/72
Termination: 06/30/79
NSF Program Manager:
Dr. Raymond Hannapel

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

DEVELOPMENT OF MODULAR COURSES IN SCIENCE, TECHNOLOGY AND SOCIETY FOR UNIVERSITY FRESHMEN AND SOPHOMORES

Dr. Philip M. Becker
The Pennsylvania State University
University Park, Pennsylvania 16802

Pennsylvania State University will develop 6 lower-level introductory one-credit courses in "Science, Technology and Society" for science and engineering majors and other students in science courses. They will be modular and consist of a complete course outline and all auxiliary materials and so designed that they can be taken singly or grouped into 3-credit units. The instruction will be self-paced and programmed and the techniques for presentation will be those deemed most appropriate for the subject involved. The Division of Instructional Services at Penn State will prepare the audiovisual material and copies of the modules. The new program will be used and tested at the branch Pennsylvania campuses and the Continuing Education Division of the University also will use the material. Evaluation will be by special workshops. Contacts have been made with representatives of the National Science Teachers Association, AAAS, and the American Society of Engineering Education, among others, about convening sessions to discuss the STS material at their national meetings. National professional societies such as ACE, IEEE, and ASME are other groups which have been tentatively approached about publicizing and distribution of the modules. It is also expected to place advertisements and articles in professional journals like the Journal of Chemical Engineering and the Journal of College Science Teaching, and Physics Today.

Development in Science Education
SED75-02993
$90,000
Award Date: 06-25-75
Termination Date: 04-30-79
NSF Program Manager:
  Dr. Linda Kahan

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

EDUCATIONAL MODULES FOR MATERIALS SCIENCE AND ENGINEERING (EMMSE)

Dr. Rustum Roy
Pennsylvania State University
University Park, Pennsylvania 16802

This is a project to develop cooperative curriculum and instructional materials for the specialty fields in Materials Science and Engineering.

In addition to almost 40 modules (each covering the content of one or two university or post-graduate level lectures) in the field-test or rewrite-after-peer-review stages, a number of other activities have been completed towards setting up what might be a continuing system for improving academic and continuing education in such fields as ceramics, wood products, metallurgy, etc. Department heads have been surveyed to establish national needs for new modules, and teaching faculty surveyed to establish current practices and availabilities of texts in the various topics; and the groundwork has been laid for electronic and peer-reviewed publication of important new techniques and theories.

During the coming year, more modules will be developed and clustered together to explore how they might be conveniently interrelated for use both in classrooms and in continuing education situations. In addition, basic procedures for an on-going community-supported activity will be explored to include means for setting priorities and for inexpensive distribution.

Development in Science Education
SED-77-14149
$296,580
Award date: 09/16/77
Termination: 05/31/80
NSF Program Manager:
Dr. Gregg Edwards

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

GUIDEBOOK FOR THE IMPLEMENTATION AND THE USE OF COMPUTER GENERATED GRAPHIC DISPLAYS IN THE UNDERGRADUATE MATHEMATICS CURRICULUM

Dr. Gerald J. Porter
University of Pennsylvania
Philadelphia, Pennsylvania 19104

The initial enthusiasm towards the use of computer generated graphic displays in undergraduate mathematics education has not been followed, for the most part, by the experimentation and development called for in the recommendation of the 1967 Mathematics Panel of the Conference on Computers in Undergraduate Education. An important element hindering progress in this field is the lack of communication on this subject. Virtually no documentation is available to help the neophyte graphics user in mathematics. There has been no written evaluation of which applications work and which do not. There is no guide to pitfalls. There are no estimates of costs.

The proposers plan to experiment with graphics equipment at the University of Pennsylvania and try to answer such questions. In addition they plan to query colleagues at other institutions and ask them to record their experience. Based upon the experience and information gathered from others a monograph will be written for wide distribution. This monograph will contain information about the use of computer generated graphics in undergraduate education, information about available hardware and software, sample modules which can be adapted for use at other schools, and a general bibliography on related topics.

Development in Science Education
SED76-20654
$68,200
Award: 07-19-77
Termination: 12-31-80
NSF Program Manager:
Dr. Dorothy K. Deringer

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

DEVELOPMENT OF INSTRUCTIONAL MODULES ON THE ENVIRONMENT

Dr. John J. Holleman
Peralta Community College District
Oakland, California 94610

The Peralta Community College District and the League for Innovation in the Community College will develop interdisciplinary instructional materials in science education focusing on the human being's impact on specific environmentally important areas within the continental United States. The first phase of this project will be a trial effort to develop materials for two such areas. Ten instructional modules will be prepared along with a somewhat larger number of micro-modules which will in turn be field tested and revised. Both of the trial areas will be on the west coast and they will be prepared at 10-14 day summer sessions by faculty members working in interdisciplinary teams. The materials produced will be processed and catalogued and disseminated to forty-eight community colleges that are members of the League.

Development in Science Education
SED77-17962
$111,500
Award date: 09-16-77
Termination: 06-30-79
NSF Program Manager:
  Bill G. Aldridge

DEVELOPMENT OF CURRICULUM AND INSTRUCTIONAL MATERIAL IN APPLIED SOCIOLOGY

Dr. Jiri Nehnevajsa
University of Pittsburgh
Pittsburgh, Pennsylvania 15260

Initially the grant provided support of instructional materials for an M.A. program in Applied Sociology, emphasizing the case study method. NSF funds were used primarily for staff salaries, visiting lecturers and consultants, and partial support for stipends for supervised internships outside the university setting. An amendment was made to permit support for an additional year to complete the preparation of the instructional materials and permit experimentation with videocassettes and give partial support for a terminal workshop conference in the fall of 1976. The final award will allow adding three additional participants to the conference roster and provide funds for editorial work in preparation of the conference proceedings for publication.

Development in Science Education
SED72-07748
$127,815
Award Date: 10-11-72
Termination Date: 03-31-80
NSF Program Manager:
  Dr. Linda Kahan

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

DEVELOPMENT OF A COOPERATIVE GRADUATE PROGRAM IN ENGINEERING AND PUBLIC ADMINISTRATION

J. I. Weindling
Polytechnic Institute of New York
Brooklyn, New York 11201

This project contemplated the development of a joint graduate program in Engineering and in Public Administration leading to a dual Masters degree after two years of full-time study. This program is intended to develop competent engineers who can assume a role in those segments of government and industry which are largely concerned with problems of public administration and where in the past the influence of the engineer in planning and decision making has been highly limited. The program, which will be open to qualified applicants with an undergraduate engineering degree, will be conducted jointly by the faculties of the School of Engineering and Science and the Graduate School of Public Administration. It will attempt to bridge the gap between these fields not only by course work in both schools but also by the introduction of a joint "project" course, by the addition of case study material, and by joint seminars on problems relating to engineering in the sphere of public administration. Support is provided primarily for staff salaries, including the project director, associated faculty, secretary, and graduate assistants.

Development in Science Education
SED71-04472
$128,985
Award date: 10/07/71
Termination: 06/30/79
NSF Program Manager:
Dr. Gene D'Amour

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

DEVELOPMENT OF LABORATORY AND LECTURE MATERIALS FOR OCEANOGRAPHY TEACHING

Dr. Robert A. Phinney
Princeton University
Princeton, New Jersey 08540

Two tasks are planned, to provide materials for use in teaching Oceanography in college or university to nonspecialists. (1) A series of computer-generated movies are being developed to provide illustration of a variety of dynamical phenomena in physical, chemical, and biological oceanography. These are done using the advanced facilities of the Geophysical Fluid Dynamics Laboratory, NOAA, and include such phenomena as: surface and internal wave motion, propagation of dispersed waves, tsunami propagation, development of a thermocline, geostrophic flow, the development of an algal bloom and consequent anoxia, throughout the CO_2 in the ocean-atmosphere system. (2) Comprehensive multi-disciplinary data sets are being assembled for three critical and contrasting regions: the New York Bight, the South Florida carbonate platform, and the Southern California coastal ocean. These comprehensive geological, hydrographic chemical, and biological data sets form the basis for integrative laboratories, and are being supplemented by 35 mm slide sets for parallel lectures and discussions. As compiled and annotated, these materials should be useful for undergraduate instruction at all levels.

Development in Science Education
SED77-18816
$45,800
Award date: 09-06-77
Termination: 02-28-79
NSF Program Manager:
Dr. Ruth E. Von Blum

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

DEVELOPMENT AND DISTRIBUTION OF PRINT MODULES FOR MANUFACTURING PRODUCTIVITY EDUCATION

Dr. Joseph El Gomayel
Purdue University
West Lafayette, Indiana 47907

This project will develop and distribute print module type learning units which can be used by academic and continuing education curricula that deliver education on topics associated with manufacturing productivity. These modules will emphasize the modern (often computer-based) aspects of manufacturing technology (engineering) which textbooks do not contain.

The goals of the project are to be achieved by a continuation of the now on-going project "A Program for the Development and Distribution of Modularized Educational Materials for Manufacturing Productivity Education." This project, underway since September 1975 with NSF support, and known by the acronym MAPEC (Manufacturing Productivity Education Committee), has progressed according to its proposed schedule: eighteen modules are now in production.

The continuation work will include the creation of additional modules and the development of a data base management system information source on manufacturing productivity education materials in addition to the further improvement of a well-working steering committee task force organization.

Development in Science Education
SED75-20464
$257,970
Award date: 07/22/75
Termination: 02/29/80
NSF Program Manager:
Dr. Gregg Edwards

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

MASTER OF SCIENCE DEGREE IN APPLIED MATHEMATICS

Dr. Richard C. DiPrima
Dr. William E. Boyce
Rensselaer Polytechnic Institute
Troy, New York 12181

The master of science degree in mathematics has traditionally signified the completion of a course of study to prepare the student for work in academic surroundings. This proposal requests support for the development of a program of study leading to the master of science degree in applied mathematics that is specifically planned for students who intend to work outside of academia, that is, in industry or government. The most important innovation is the creation of a course on "mathematical modeling" at a high level of sophistication. Suitable text materials will be prepared from transcribed notes since satisfactory text materials are largely non-existent. Part of the instruction in this course will be provided by active practitioners of applied mathematics in industry and government as parts of teaching teams. Cooperative work-study programs and internships, as well as visiting faculty, will constitute an interactive program between RPI, government, and industry. In addition to mathematical modeling, other degree requirements will be drawn up to assure that each graduate has a sound knowledge of at least one field of application, and of the mathematical methods currently useful in that field.

An advisory committee of mathematics practitioners from industry and government, and mathematicians from other universities or national professional societies, will be formed to help identify new areas of application, sources of possible industrial support to aid in making the program self-sustaining and possible lecturers for the courses. The course materials will be made available nationally and the program will be discussed via appropriate journal articles and lectures at professional meetings.

Development in Science Education
SED75-03520
$176,000
Award: 02-19-75
Termination: 05-31-79
NSF Program Manager:
Dr. Dorothy K. Deringer

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

THE PREPARATION OF SUPPLEMENTAL INSTRUCTIONAL UNITS BASED ON CURRENT CRUSTAL RESEARCH FOR USE IN GRADES 8-10

Dr. Edward C. Stoever, Jr.
Southeast Missouri State University
Cape Girardeau, Missouri 63701

This project is for the development, as supplements to existing curricula in grades 8-10, of a set of 1-3 day instructional units which are based on current scientific research into the composition, history, and processes of the earth's crust and the applications of this knowledge to man's activities. This project is intended to provide one model for shortening the time lag for translation of ongoing research into useful classroom materials. Supplements will be designed to be low cost, activity-oriented, adaptable to a variety of subjects and will stress human implications of content. Development will be conducted at several sites by teams consisting of researchers knowledgeable in current work in crustal evolution, local classroom teachers, and other experts.

Development in Science Education
SED77-08539
SED78-25104
FY 1977: $321,400
FY 1978: $172,540
Award Date: 8-22-77
Termination Date: 7-31-80
NSF Program Manager:
Dr. Linda Kahan

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

UNIVERSITY LEVEL, COMPUTER-ASSISTED INSTRUCTION (CAI) AND COMPUTER-GENERATED SPEECH IN MATHEMATICS

Dr. Patrick Suppes
Stanford University
Stanford, California 94305

This project is concerned with performing research on computer-based instruction (CAI) in university-level courses and with 1) the development of efficient computer-based procedures for informal mathematical proof and argument, and 2) the development of effective computer-generated speech.

"Informal mathematics" is an essential part of much university-level science instruction, such as chemistry, physics, economics or statistics. Thus, a student should be able to present proofs to the computer in a way that is comparable to usual mathematical practice. As a result, one part of this project will develop improved and efficient student-machine proof procedures. Particular features of the research will be the global structure of proofs, methods for planning proofs and an interactive theorem prover.

At the present time, most CAI works principally through the use of print materials. The use of computer-generated audio will make CAI more practical; therefore, work will be conducted on hardware and systems with speech outputs to make them more natural for the student user, and the Voice Oriented Curriculum Author Language which will be made more efficient for the curriculum authors. Emphasis will be placed on providing more realistic sounding computer-generated sentences.

Development in Science Education
SED77-09698
$701,000
Award date: 08-08-77
Termination: 12-31-79
NSF Program Manager:
Dr. Andrew R. Molnar

DEVELOPMENT OF SELECTED UNDERGRADUATE COURSE MATERIALS IN APPLIED MATHEMATICAL MODELING

Dr. Edward Beltrami
State University of New York at Stony Brook
Stony Brook, New York 11794

The purpose of this project is to develop a set of new undergraduate modules in applied mathematics directed towards sensitizing students to problems of current societal interest not presently encompassed by traditional mathematical education. The resultant modularized materials will consist primarily of case experiences, with each illustrating a significant mathematical modeling idea and its ultimate use. These materials are designed for students likely to select concerns in the public sector. The areas to be encompassed by these modules include population growth and demography, municipal services, health care delivery, ecology and environment, and regional growth.

Development in Science Education
SED76-05433
$131,700
Award: 11-19-76
Termination: 04-30-80
NSF Program Manager:
Dr. Dorothy K. Deringer

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON. D.C. 20550

MODULAR MATERIALS ON SOCIO-TECHNOLOGICAL PROBLEMS AND ISSUES

Dr. Thomas T. Liao
State University of New York at Stony Brook
Stony Brook, New York 11794

A set of 10-15 case studies will be developed and disseminated to other engineering colleges. Each case study will focus on a particular national socio-technological problem of current and future importance. Representative topics are individual water conservation, building access for the handicapped, home fire protection, and high-speed ground transportation.

The case studies will be used both to broaden the base of engineering education and to strengthen the education of non-engineering students for technological literacy. They will be appropriate for courses in the core curriculum of undergraduate engineering. They will also be usable in engineering courses for students in the liberal arts or in professions not heavily based on the physical sciences. To satisfy both markets, each study will be in three parts: (1) an information-reference document describing the history and model of the problem and the situation in other nations, (2) an engineering extension with problems suitable for engineering students, and (3) a non-technical extension stressing public options, decision possibilities, and technology assessment.

Primarily in printed form, each study will be designed for use in a recitation section under the direction of a relatively untrained teacher or graduate student. Thus, each case study must include both required information and discussion questions and student activities.

Development in Science Education
SED77-19298
$131,170
Award: 09-19-77
Termination: 02-29-80
NSF Program Manager:
  Dr. Dorothy K. Deringer

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

COMPUTER-ORIENTED TEACHING MODULES IN GEOCHEMISTRY

Dr. Philip C. Goodell
University of Texas, El Paso
El Paso, Texas 79968

This project is designed to produce integrated teaching modules on selected topics in geochemistry. These modules provide simulated geochemical systems with which students interact as a mechanism for understanding geochemical processes. This interaction is provided by the incorporation of computerized data analysis with both numerical and graphical output.

Topics being treated by the teaching modules are stability relations as determined by thermodynamic parameters, geochemical prospecting, and geochemical cycles. The modules are being tested and evaluated in actual teaching situations. Final versions will be publicized and made available to the teaching community. The development and utilization of these modules it is hoped will provide an effective teaching medium for graduate and undergraduate students.

Development in Science Education
SED77-18520
$16,500
Award date: 09-16-77
Termination: 03-31-79
NSF Program Manager:
  Dr. Ruth E. Von Blum

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

SERVICE-ORIENTED OPTIONS IN MATHEMATICS

Dr. Donald Bushaw
Washington State University
Pullman, Washington 99163

Washington State University will initiate a four-year project, to be coordinated with a similar project at Clemson University, to develop an alternative doctoral program for mathematicians contemplating careers in business, industry, and government. Graduates will not only be prepared in core mathematics, but will have expertise in dealing with technical problems arising outside of mathematics. Distinctive features of the program include training in a non-mathematical option, interdisciplinary courses and seminars where emphasis is placed on active involvement in mathematical modeling; on-campus and off-campus internships; and doctoral dissertations showing research competence with problems in which mathematics is applied to significant "real-world" problems.

Development in Science Education
SED75-17322
$204,895
Award: 06-25-75
Termination: 05-31-79
NSF Program Manager:
Dr. Linda Kahan

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

PHYSICAL PROCESSES IN TERRESTRIAL AND AQUATIC ECOSYSTEMS

Dr. Douglas G. Chapman
University of Washington
Seattle, Washington 98195

This is a project to develop an interdisciplinary study program at the advanced undergraduate and graduate level addressed to the needs and focussed on a quantitative description of physical processes in biological systems. It is intended to complement and strengthen ongoing graduate programs in botany, zoology, chemistry, forestry, fisheries, oceanography, and the environmental sciences. Because of the complexities brought about by combining biology, physical science, and mathematical analysis, it is considered to be essential to make extensive use of computers in the program and to accomplish this in such a way as to substantially reinforce student comprehension and also to assure ready adaptability of the program to other institutions. A national advisory committee is aiding in the planning of the program to ensure maximum accommodation of program materials on a wide-ranging basis. The program itself consists of a set of modules which emphasize the classical theories of thermodynamics, irreversible thermodynamics, theory of diffusion, fluid motion, and mass and energy transport as they apply to processes in organisms and in ecosystems. The program embraces a modular structure in order that virtually all of the modules can be used independently or in various combinations. The program is intended not only to improve the education of ecologists but substantially to reinforce modeling research programs in ecosystems in North American universities. It is also expected to contribute considerably to resource management, one of the primary objectives of the Center for Quantitative Science when it was originally established under a Ford Foundation grant.

Development in Science Education
SED74-17696
$457,800
Award date: 05-31-74
Termination: 09-30-79
NSF Program Manager
Dr. Ruth E. Von Blum

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

GRAPHIC TECHNIQUES FOR TEACHING STATISTICAL CONCEPTS AND PROCEDURES

Marshall J. Graney
Wichita State University
Wichita, Kansas 67208

Eight instructional packages will be developed to teach undergraduate social science students certain statistical inference procedures by means of graphic techniques. Parallel materials will be developed for students and instructor, including teaching guides and visual aids. The proposer has already developed two packages that will be used at the start of the project for initial evaluation which in turn will supply inputs for further developments. The evaluation plan includes an experimental design to compare learning effectiveness of graphic methods with more traditional methods, and also involves the use of survey questionnaires. Dissemination will be accomplished through publications, workshops, and other channels existing in interested professional organizations.

Development in Science Education
SED77-18437
$10,800
Award date: 09/08/77
Termination: 03/31/79
NSF Program Manager:
Dr. Gene D'Amour

12/1978

SOCIOTECHNICAL SYSTEMS DESIGN PROGRAM

Dr. Gerald Nadler
University of Wisconsin - Madison
Madison, Wisconsin 53706

The program involves a cohesive set of courses in engineering topics, specifically arranged for seniors and graduate students in the social sciences. The chief objective is to translate engineering systems and technology concepts into nonengineering contexts as tools for social scientists. Special courses, particularly one in "systems-control-modeling," will be developed. Students will be trained to deal with societal problems which have a considerable engineering component, and an effort will be made for a senior concentration. A minor will be offered at the Master's level for social science majors, and a joint or dual Master's in social science and/or engineering will be established. It is planned to have national input by using a national evaluation component, to disseminate information on the courses and concepts, and to distribute materials nationwide after they have been tested.

Development in Science Education
SED75-17159
$153,310
Award date: 06/16/75
Termination: 01/31/80
NSF Program Manager:
Dr. Dorothy K. Deringer

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

THE WORCESTER POLYTECHNIC INSTITUTE PLAN

Dr. William R. Grogan
Worcester Polytechnic Institute
Worcester, Massachusetts 01609

Funds from this grant support in part the implementation at Worcester Polytechnic Institute (WPI), Worcester, Massachusetts, of the "WPI Plan". The "Plan" is a unique, innovative, educational scheme which permits a completely flexible educational program tailored to the goals and needs of the individual student. Traditional degree requirements of credit accumulation are abolished under the Plan and in their stead each student demonstrates competence in his chosen field. The new degree requirements include demonstration by the student of his competency in his major field by means of a comprehensive examination; research work on two projects, one in the major field and one in an activity which relates technological advance to human need; and demonstration of competence in a minor program. Funds from the National Science Foundation will contribute to four major aspects of the "Plan": (1) the development of an advising system and the training of faculty advisors; (2) the development of student projects for independent study; (3) the development of comprehensive examinations to test student competency in major and minor fields; and (4) evaluation of the program.

The potential effect of the WPI "Plan" is two-fold: (1) it will completely change the organization of the educational program at WPI altering the roles of both faculty and student; and (2) it will grant to the student the responsibility for developing, with faculty guidance, his own, individualized, academic program which will lead him to his degree.

Development in Science Education
SED72-06444
$1,211,500
Award: 05-15-72
Termination: 05-31-79
NSF Program Manager:
Dr. Dorothy K. Deringer

CONTINUING EDUCATION

FOR

SCIENTISTS AND ENGINEERS (B)

American Chemical Society 1
American Society for Engineering Education 2
AAMI (Association for the Advancement of Medical Instrumentation) 3
Association of Media-Based Continuing Education 4
Battelle Memorial Institute 5
Battelle Memorial Institute 6
California State University, Long Beach 7
California State University, Northridge 8
University of California, Berkeley 9
University of California, Los Angeles 10
Cooper and Company 11
George Mason University 12
Harvard University 13
Industrial Research Institute Research Corporation 14
University of Kentucky 15
Medical University of South Carolina 16
University of Missouri 17
National Engineering Consortium, Inc. 18
North Carolina State University 19
Pennsylvania State University 20
Pennsylvania State University 21
Polytechnic Institute of New York 22
Rockwell International 23
University of Wisconsin-Extension 24
University of Wisconsin, Oshkosh 25

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

MULTIMEDIA USER-CONTROLLED MODES OF CONTINUING EDUCATION IN CHEMISTRY

Moses Passer
American Chemical Society
Washington, D.C. 20036

The American Chemical Society proposes, on the basis of its experience with a variety of continuing education programs, to develop a system for designing, producing, evaluating, marketing, and distributing continuing education materials in chemistry that are extensively supplemented with computer-augmented instruction and self-pacing audio-visual techniques. These user-controlled short courses will be constructed to facilitate individual use at the discretion and under the control of the student-user, without precluding their use for group instruction. As an important element of the project, extensive documentation and appropriate software materials will be made available to assist other societies who desire to initiate programs to produce similar continuing education materials in their respective disciplines. Modes of instruction include computer-assisted instruction, color videocassettes, audiocassettes, films, and/or printed material. Each of the 10 or so units will be comprised of 16-24 hours of instruction. Educational Testing Service will devise tests to determine satisfactory mastery by the students of the material presented. In-plant field testing of the suitability and value of the units will be made by a few employers from industry, government agencies or by local ACS chapters for testing outside the employment environment.

Continuing Education
Development in Science Education
SED74-20727
$839,135
Award date: 06/28/74
Termination: 06/30/80
NSF Program Manager:
Dr. Gene D'Amour

FIRST WORLD CONFERENCE ON CONTINUING ENGINEERING EDUCATION

Professor John P. Klus
American Society for Engineering
Education/Continuing Education
Studies Division
432 N. Lake Street
Madison, WI 53706

The First World Conference on Continuing Engineering Education, scheduled for April 25-27, 1979, is being sponsored by UNESCO, the Pan American Health Organization, the American Society for Engineering Education, and the University of Mexico. The conference is designed for continuing education directors in industry, government, professional societies, and universities who are interested in developing, promoting, and conducting continuing education programs. Presentations will be made by persons actively working in the field from all parts of the world. The three-day conference has been designed to allow for formal presentations, individual workshops on special topics, and special interest group discussions. Conference languages will be English, French, and Spanish. Proceedings will be prepublished in English.

Continuing Education
Development in Science Education
SED78-21854
$36,310
Award date: 09/25/78
Termination: 09/30/79
NSF Program Manager:
Dr. Gene D'Amour

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

CONTINUING EDUCATION FOR EMPLOYED CLINICAL ENGINEERS

Cesar A. Caceres
AAMI Foundation
Arlington, Virginia 22209

An initial study will be undertaken to determine the extent and degree of current opportunity, need and potential for continuing education for clinical engineers employed in hospitals and other non-academic organizations. This is to be followed by the development of a workshop/conference to specifically address the findings of the initial study in the project. Throughout the project each step will be reviewed by an advisory body representing the fields involved. Additional evaluation will be by "polls" taken during the project and at its conclusion to monitor impact in the area. It is expected that the problem definition and analysis will produce recommendations and suggestions suitable for public dissemination and policy discussions. A proceedings and an analytical review based on all input will be published to communicate the results to the maximum interested audience. The major goal is to provide a transferable model for continuing education in similar areas of engineering where there is a geographic dispersion or lack of communication among employed engineers of similar specialities.

Continuing Education
Development in Science Education
SED78-21937
$55,440
Award date: 09/25/78
Termination: 03/31/81
NSF Program Manager:
Dr. Gene D'Amour

UNIVERSITY CONSORTIUM TO INCREASE NATIONAL EFFECTIVENESS OF CONTINUING EDUCATION FOR ENGINEERS

Charles R. Vail
Association for Media-Based Continuing
Education for Engineers, Inc. (AMCEE)
Georgia Institute of Technology
Atlanta, Georgia 30332

The Association for Media-Based Continuing Education for Engineers, Inc. (AMCEE) is a consortium founded by twelve charter-member universities (now expanded to seventeen), formed to increase and improve, nationwide, the range and effectiveness of continuing education for practicing engineers, through coordination of their efforts in the management, development, and delivery of video-based instructional materials. Funds for course and teaching materials development are provided by a revolving-fund grant from the Sloan Foundation. Other start-up and organization development costs will be borne in part by the NSF grant.

Specifically, AMCEE will work closely with industry, professional societies and practicing engineers to determine continuing education needs and to provide information and guidance to member institutions. A few modest surveys will be carried out early in the project and a mechanism developed for exchange of information and materials among member institutions. Conferences will publicize existing materials and explore ways to share them. Ways will be sought to assist member instititions in distribution efforts, and to broaden the user base -- i.e., to reach engineers working in areas remote from AMCEE institutional distribution systems.

The overall objective is to guide and promote the development and expansion of a network of institutions engaged in the use of video-based instructional materials for delivery of continuing education, for-credit and not-for-credit, to a broad range of practicing engineers.

Continuing Education
Development in Science Education
SED77-22909
$135,771
Award date: 05/24/78
Termination: 10/31/79
NSF Program Manager:
Dr. Gene D'Amour

12/1978

A SURVEY OF CONTINUING EDUCATION FOR NONACADEMIC SCIENTISTS AND ENGINEERS PROVIDED BY INDUSTRY AND GOVERNMENT

Dr. Girard W. Levy
Battelle Memorial Institute
Columbus, Ohio 43201

The goal of the project is to assess the nature and extent of continuing education for nonacademic scientists and engineers supported by industry and government. To accomplish this goal, a national survey of industrial and governmental organizations employing scientists and engineers will be conducted. The survey will focus on (a) magnitude of continuing education activities, (b) type and extent of organizational support for continuing education activities, and (c) employee motivations for participation in continuing education, and degree of satisfaction with participation.

This study is designed to provide a useful source of information for persons concerned with the careers of scientists and engineers.

Continuing Education
Development in Science Education
SED77-18565
$98,133
Award date: 09/23/77
Termination: 01/31/79
NSF Program Manager:
Dr. Gene D'Amour

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

NEEDS ASSESSMENT OF CONTINUING EDUCATION DELIVERY SYSTEMS FOR SCIENTISTS AND ENGINEERS EMPLOYED IN SMALL, GEOGRAPHICALLY-DISPERSED PLANTS

Lawrence G. Welling
Battelle Memorial Institute
Columbus, Ohio 42301

The objective of the proposed work is threefold: (1) to identify and define the continuing education needs of scientists and engineers employed in small, geographically-dispersed industrial plants; (2) to determine if the identified continuing education needs are different from those of scientists and engineers employed in urban-based industrial plants, both large and small; and (3) to identify and define the delivery systems used to meet the continuing education needs of scientists and engineers employed in small, geographically-dispersed plants.

Tasks to be performed in conducting the study are: (1) Develop survey instruments and prepare survey materials, (2) Select a sample of establishments, (3) Implement the data management system, (4) Conduct the pretest, (5) Conduct the full survey, and (6) Analyze and interpret the data.

This study will provide a useful source of information for persons concerned with the delivery of continuing education to scientists and engineers. Those involved with the delivery of continuing education will benefit from the study. The results of the study will be an important step in the formulation of policy and/or programs to improve the continuing education delivery systems for scientists and engineers employed in small, geographically-dispersed plants.

Continuing Education
Development in Science Education
SED78-21943
$77,908
Award date: 09/29/78
Termination: 05/31/80
NSF Program Manager:
Dr. Gene D'Amour

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON D C 20550

REGIONAL WORKSHOP FOR CONTINUING EDUCATION OF WORKING-LEVEL SCIENTISTS AND THEIR SUPERVISORS

Roger D. Bauer
School of Natural Sciences
California State University,
Long Beach
Long Beach, California 90840

A three-day workshop for working-level scientists and their supervisors will be held to provide for an assessment of the anticipated continuing education needs of these individuals. The first day of the workshop will involve the working-level scientists in their own needs assessment of their perceived desirability of further education and training. They will be given as much freedom as possible in suggesting possible solutions to their problems of remaining current in their working situations. Participants will be drawn from experienced scientists in all of the major areas of natural science. University faculty will be acting as guides for these working-level scientists in the assessment of their needs and the development of their suggested solutions. The second day of the workshop will separately involve the supervisors of these, or comparable, working-level scientists. These supervisors will be asked to provide the needs assessment of their employees' continuing education. The third day of the workshop will involve both groups working together with special attention directed toward providing the solutions to the continuing needs of these working-level scientists. The information from the workshop will be disseminated as widely as possible and efforts will be made to actually institute suggested programs arising from this workshop.

Continuing Education
Development in Science Education
SED78-21606
$9,350
Award date: 09/25/78
Termination: 03/31/80
NSF Program Manager:
Dr. Gene D'Amour

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

WORKSHOP ON CONTINUING EDUCATION FOR INDUSTRY, PROFESSIONAL SOCIETIES AND UNIVERSITIES

Sonja S. Marchand
California State University, Northridge
Northridge, California 91330

The proposed workshop is an effort to bridge the long standing ideological gap between engineering industry, professional societies, and higher education in the development of courses for continuing education. The objective is to provide a method for the effective communication and understanding of the continuing education needs of practicing engineering professionals in industry and business by identifying and exploring the differing perceptions of engineering continuing education course content in the areas of management and technical curricula. The means for achieving this objective will be implementation of a three-day workshop composed of project-centered seminars addressing specific engineering disciplines and resulting in a published text of recommendations with national application for successful implementation of continuing education programs.

Continuing Education
Development in Science Education
SED78-21942
$30,544
Award date: 09/25/78
Termination: 07/31/79
NSF Program Manager:
  Dr. Gene D'Amour

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

AN EVALUATION MODEL FOR STATE OF THE ART PROGRAMS FOR PROFESSIONAL ENGINEERS

Martha Maxwell
Univeristy of California, Berkeley
Berkeley, California 94720

The purpose of this study is to identify, describe and attempt to evaluate criteria for assessing the impact of Extension's "State of the Art" programs on professional engineers and their ability to apply this new knowledge to their work. Also the study will investigate variables including course organization and instructional strategies, selected student characteristics and work situations which enhance and/or impede use of new knowledge and skills.

The study will involve questionnaires to engineers enrolling in the programs, instructors who teach the courses, and a small sample of engineer participants who agree to serve as "case studies" and submit to interviews and other follow-up procedures.

It is anticipated that the study will lead to a set of descriptive guidelines for organizing and improving instruction in State of the Art programs for engineers, a set of criteria and an evaluation model that can be more widely tested in extension programs with other "State of the Art" programs.

Continuing Education
Development in Science Education
SED78-22138
$29,746
Award date: 09/25/78
Termination: 03/31/80
NSF Program Manager:
Dr. Gene D'Amour

EVALUATION OF SHORT COURSE METHOD OF INSTRUCTION FOR PRACTICING PROFESSIONALS IN ENGINEERING

Alfred C. Ingersoll
The University of California
Los Angeles, California 90024

This proposal, submitted by Continuing Education in Engineering and Mathematics, UCLA Extension, and the UCLA Center for the Study of Evaluation, requests $48,582 for a one-year study, commencing April 1, 1979, of the comparative effectiveness of two methodologies used in teaching two UCLA short courses, "Digital Filters," and "Kalman Filtering." Each course will be presented once on the east coast and once on the west coast, in the summer of 1979, utilizing radically different teaching methodologies, viz. (a) lecture/blackboard style, with a linear sequential type of presentation, and (b) extensive use of two overhead projectors so that the student can learn the relationship and organization of a wide array of fact, theory, application and example. Domain referenced pre-tests, post-tests and retention tests at 4 weeks and 4 months will establish the relative effectiveness of the two teaching techniques. Complex statistical analysis of test data will be required to accommodate variations in mathematical and educational background, age and employment of the participant and geographical environment of the course. Results of the study will have wide applicability to short courses given anywhere and to after-hours courses and regular college courses.

Continuing Education
Development in Science Education
SED78-21979
$48,582
Award date: 09/25/78
Termination: 03/31/80
NSF Program Manager:
Dr. Gene D'Amour

AN INVESTIGATION INTO LEARNING PATTERNS OF ADULTS IN ALTERNATIVE MODES OF CONTINUING ENGINEERING EDUCATION AS COMPARED WITH THOSE OF UNDERGRADUATES AND GRADUATES

Bernard N. Samers
Cooper and Company
Stamford, Connecticut 06905

The proposed project will contrast the effects of learning styles or patterns of three types of students--employed engineers in a continuing education program, and graduate and undergraduate engineering students--enrolled in graduate engineering courses offered by the University of Bridgeport upon specific educational outcomes. Such individual variation--referred to as cognitive style--has been previously shown to significantly affect student learning behavior and student-teacher interactions. The students who will be asked to participate in the study will be drawn from three distinct types of courses: lecture courses, small seminars, and tutorials. The lecture courses will be subdivided into two categories based upon the degree of active student participation. The study design takes advantage of special situations at the University of Bridgeport's Graduate School of Engineering, where a single set of courses is utilized by undergraduates, graduates, and for the continuing education of practicing engineers. The study will involve 120 students, drawn approximately evenly from the three student categories and four types of courses, and faculty of these courses. Because the proposed research involves a relatively small sample of students and faculty, the research should be regarded as a pilot study whose goals are to ascertain fundamental relationships (but not high order interactions) and to identify and pinpoint those research areas which are prime targets for future in-depth investigation.

Continuing Education
Development in Science Education
SED78-21868
$34,695
Award date: 09/30/78
Termination: 07/31/79
NSF Program Manager:
Dr. Gene D'Amour

12/1978

CEXY: A TOOL FOR ASSESSING REGIONAL CE NEEDS IN XY COORDINATES

Robert Ehrlich
George Mason University
Fairfax, Virginia 22030

The object of this proposal is to conduct a study of the state of CE for engineers and physicists (E&P) in the Washington metropolitan area. This will be coupled with a regional needs assessment implemented by a novel mathematical technique, CEXY, which makes it possible to numerically determine specific CE needs as a function of XY coordinates on a map. This unique method contrasts sharply with conventional approaches to needs assessment because it allows needs to be determined as a function of location in a geographically unbiased way. It is, therefore, much more consumer-oriented than supplier-oriented. Morever, CEXY is highly quantitative, in that it will yield the numerical magnitude of CE needs as a function of position. Because it is completely subject matter independent, the CEXY method of needs assessment is replicable in any other academic discipline.

The proposed study will focus on the relative magnitude of obstacles to more effective CE within universities, as well as ways such obstacles can be eliminated. Data used in the study will be collected by both questionnaires and interviews from CE suppliers and CE consumers. Upon completion of the study, the results will be presented at a two day conference held at George Mason University and disseminated in articles for professional journals and publications.

Continuing Education
Development in Science Education
SED78-21866
$40,503
Award date: 09/25/78
Termination: 09/30/80
NSF Program Manager:
Dr. Gene D'Amour

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

PILOT STUDY OF CONTINUING ENVIRONMENTAL HEALTH EDUCATION FOR SCIENTISTS AND ENGINEERS

Dade W. Moeller
Harvard University
School of Public Health
Boston, Massachusetts 02115

This is a pilot study designed to obtain information on continuing education courses in environmental health being offered for employed scientists and engineers. The objectives are to determine the nature and extent of the courses being offered and to compare this information with the educational needs of such people as seen by federal, state and local agencies, industrial organizations, and participants in existing courses. Data will be obtained by questionnaires and interviews. For purposes of recording the data, the environmental health field will be subdivided into sub-disciplines (such as air pollution control, water pollution control, radiation protection, solid waste management, etc.), and into regulatory goals(such as detection, assessment and control). Within the matrix thus formed, those elements for which there are few or no professional training programs, and for which a demand for training has been expressed, should be indicative of the elements for which greater training opportunities need to be developed. No attempt will be made to guarantee complete coverage of the subject. Rather, the study should highlight some of the more important needs and point the way to the development of a more comprehensive study, if warranted.

Continuing Education
Development in Science Education
SED78-21867
$25,893
Award date: 09/25/78
Termination: 03/31/80
NSF Program Manager:
Dr. Gene D'Amour

12/1978

NEW DIRECTIONS IN CONTINUING EDUCATION: COMPARATIVE PERSPECTIVES OF DECISION-MAKERS AND R & D PERSONNEL

A. George Schillinger
Industrial Research Institute
Research Corporation
St. Louis, Missouri 63105

Career patterns of engineers and scientists are changing and there are good reasons to expect new trends to develop. The need for increased re-training and more frequent and intensive continuing education arises. A new division of labor between industry and academic institutions in the delivery of continuing education may become desirable or even necessary. This project will interview R & D directors of major, technology-based corporations and government laboratories to ascertain their views on future prospects of continuing education. Their responses will be compared to those elicited in similar interviews with the directors of training and personnel development in the same organizations, and with university provosts and deans responsible for planning graduate and continuing education programs. Differences in perspectives, roles, and attitudes on key policy issues affecting continuing education will be analyzed. The results will be examined in the light of what is already known from the literature about factors affecting the utilization and effectiveness of continuing education. Recommendations will be made for improving the effectiveness, relevance, timing, and planning of continuing education for the decade ahead.

Continuing Education
Development in Science Education
SED78-22139
$57,483
Award date: 09/26/78
Termination: 03/31/80
NSF Program Manager:
Dr. Gene D'Amour

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

MEASUREMENT FOR LEARNING OUTCOMES IN CONTINUING EDUCATION FOR SCIENTISTS AND ENGINEERS

David K. Blythe
College of Engineering
University of Kentucky
Lexington, Kentucky 40506

The overall objective of this proposed research is to develop, refine and field test procedures and instruments which can be used to measure the quality of learning experiences in continuing engineering and science education. These concepts are referred to in this proposal as quality measures and accountability. Strong emphasis will be placed on minimizing the anxiety level of the adult participants during such evaluation.

Specific objectives: (1) to evaluate existing quality measurement and accountability techniques as presently used; (2) to evaluate non-traditional techniques for quality measure and accountability which are presently used in non-adult/continuing education curricula; (3) to develop new techniques for quality measurement and accountability in continuing education in science and engineering.

The instruments proposed for field testing by the participating college of engineering would be rated by panels representing the fields of educational psychology, education, science, engineering, and continuing education administration.

Continuing Education
Development in Science Education
SED78-22060
$77,529
Award date: 09/25/78
Termination: 09/30/80
NSF Program Manager:
Dr. Gene D'Amour

A MODEL CONTINUING EDUCATION NEEDS ASSESSMENT/ RESPONSE SYSTEM IN SCIENCE AND ENGINEERING

Dr. John W. Zemp
Medical University of South Carolina
Charleston, South Carolina 29403

The project's objective is to design, test, and disseminate a model multi-college, multi-industry system of comprehensive engineering/scientific continuing education needs assessment and follow-through responses at the local and regional levels. The system will be pilot-tested in the Charleston tri-county area, a 2,600 square mile area of diverse, small and medium-sized industries; the 53 plants employing chemists and/or engineers will be the "target population" of the project surveys. Phase 1 project activities will be: 1. appointment of Advisory Committee broadly representative of industry and the educational community; 2. design, pre-test, and conduct of Initial Management Survey (all 53 plants) and follow-up Management and Employee Surveys (20 plants) in order to determine needs, goal, incentives, barriers, preferred delivery systems, resources for cooperative programs, etc.; 3. drawing up a series of recommended response actions. Phase 2 project activities will be: 1. outcomes evaluation survey (all 53 plants); 2. writing and dissemination of Summary Report.

Continuing Education
Development in Science Education
SED78-21851
$20,940
Award date: 09/25/78
Termination: 06/30/81
NSF Program Manager:
Dr. Gene D'Amour

CONTINUING EDUCATION NEEDS OF ENGINEERS/SCIENTISTS IN THE THREE-STATE OZARK REGION

John M. Amos
University of Missouri-Rolla
Center for Applied Engineering Management
Rolla, Missouri 65401

The objectives of the study are to determine the continuing education needs of scientists and engineers in rural areas and small communities, and to assess the relative effectiveness of various mechanisms for meeting these needs.

During the initial stages of the project, an advisory committee will be formed that represents the views of local employers, trade and professional organizations, chambers of commerce, etc. The advisory committee will review and assist in all major aspects of the project. An annotated list of continuing education mechanisms will be developed from techniques that have been successfully used by others, from review of literature on the subject, and from information from professional societies. An in-depth random survey will be made of both employers' and scientists'/engineers' perceptions of continuing education needs in the Ozark region, which is comprised of Missouri, Oklahoma, and Arkansas.

Data will be analyzed and correlated relative to statistical parameters. Present educational and training needs, as well as subject material needed as perceived by both employers and scientists/engineers, will be published from the study.

It is anticipated that in the future, a workshop conference will be held for educators, professional societies, and management, so that these groups can immediately implement more effective methods in their respective continuing education programs.

Continuing Education
Development in Science Education
SED78-21607
$44,585
Award date: 09/27/78
Termination: 03/31/80
NSF Program Manager:
Dr. Gene D'Amour

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

U.S. ELECTRONICS INDUSTRY CONTINUING EDUCATION EFFECTIVITY STUDY

Robert M. Janowiak
National Engineering Consortium, Inc.
Oak Brook, Illinois 60521

Study to determine the effectiveness of CE Programs in the electronics industry. An industry cross-section (9 element grid) survey will seek information on CE programs, effectiveness, major criteria and important CE variables. Past participants in CE programs will be surveyed to determine their CE experience, characteristics, desirable features and application of information. Both mail and telephone surveys will be conducted. Data analysis will result in the development of effective CE models.

Continuing Education
Development in Science Education
SED78-21923
$38,600
Award date: 09/25/78
Termination: 03/31/81
NSF Program Manager:
Dr. Gene D'Amour

CONTINUING EDUCATION FOR SCIENTISTS AND ENGINEERS: DELIVERY SYSTEMS IN NORTH CAROLINA

Daniel E. Harrell
School of Engineering
North Carolina State University
Raleigh, North Carolina 27650

The Industrial Extension Service (IES), School of Engineering, North Carolina State University proposes that it conduct a study designed to:

- Identify and describe continuing education (CE) resources currently being utilized by North Carolina engineers and scientists to maintain and extend their professional competence and capabilities.

- Determine the extent of use and the perceived effectiveness of these educational resources in meeting the CE needs of North Carolina engineers and scientists.

- Identify deficit CE needs of North Carolina engineers and scientists and the preferred delivery systems.

In particular, the proposed study should yield important data and information regarding the delivery of CE programs to employees of relatively small, geographically-dispersed companies. A random sample of North Carolina's 30,000 engineers and scientists will be surveyed by selected engineering faculty and IES professional staff members. The proposed sampling procedures will have a sampling error of less than 3.06 percent.

Continuing Education
Development in Science Education
SED78-21865
$67,581
Award date: 09/25/78
Termination: 03/31/81
NSF Program Manager:
Dr. Gene D'Amour

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

BEHAVIOR ANCHORED SCALES - A METHOD OF IDENTIFYING CONTINUING EDUCATION NEEDS OF ENGINEERS

James L. Farr
The Pennsylvania State University
University Park, Pennsylvania 16802

The goal is to construct a set of behavior anchored scales that can be used by supervisors of engineers to assess the continuing education needs of engineers in small and medium sized companies. To accomplish this goal a sample of 140 supervisory engineers from approximately 40 companies from the eastern and mid-west region will participate in a series of sequential workshops. The design of the study comprises four phases: Dimension Identification; Allocation of Behavioral Items to Dimensions; Scaling of Behavioral Items; and Applications. The objectives of the workshops are to identify dimensions of updating behavior based on actual observed on-the-job behaviors. The instruments will provide supervisory engineer with a set of scales that are reliable and valid and enable him to perform his professional development and career planning with his subordinates in a constructive and purposeful manner because appropriate communication and feedback can take place. The engineer can anticipate that his professional development review will provide a serious discussion of specific educational strengths and weaknesses based on specific instances rather than generalities. For the organization the instrument will provide an acceptable, reliable and valid instrument for updating engineers for self-renewal purposes at the individual and organizational level. The acceptability will be high because engineers participated in its construction.

Continuing Education
Development in Science Education
SED78-21940
$44,888
Award date: 09/25/78
Termination: 03/31/80
NSF Program Manager
Dr. Gene D'Amour

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NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

RELATIONSHIPS AMONG INDIVIDUAL MOTIVATION, WORK ENVIRONMENT AND UPDATING IN ENGINEERING

James L. Farr
The Pennsylvania State University
University Park, Pennsylvania 16802

This project examines the relationship between work motivation, work environment and updating of engineers. Dubin's multidimensional model of updating hypothesizes that updating is influenced by two categories: motivation and work environment. The work environment consists of five components: organizational climate, job content and design, supervisor-subordinate relationships, peer interaction and management policy. The goal of the project is to construct a set of instruments which constitute the motivation variables and the variables of each of the work environment components. Group interviews will be held with managers and engineers in ten large and medium sized companies employing engineers and five governmental organizations. The sample will be drawn from eastern and mid-western organizations to obtain a reasonable representation. The outcomes will consist of a set of instruments that can be used for: diagnostic purposes for assessing updating; identify where corrective actions are needed; provide feedback on the effectiveness of current methods and problems regarding updating; and mid-career assessment. A number of potential outcomes are described which accrue to the engineer and organizations where updating is promoted. Finally, a recommendation on the dissemination of results is suggested.

Continuing Education
Development in Science Education
SED78-21941
$41,819
Award date: 09/25/78
Termination: 03/31/80
NSF Program Manager:
Dr. Gene D'Amour

FACTORS DETERMINING THE EFFECTIVENESS OF CONTINUING EDUCATION: LONGITUDINAL ANALYSES IN ENGINEERING ORGANIZATIONS

Harold G. Kaufman
Polytechnic Institute of New York
Brooklyn, New York 11201

The objective of the proposed research will be to investigate the relationship of participation in continuing education (CE) to job performance and professional development of engineers. The research will be designed to answer questions such as the following: 1. What characteristics of the individual, the work and the organization determine participation in specific CE modes by engineers? 2. Which CE modes are related to improved job performance and enhanced professional development of engineers? 3. What are the characteristics of specific CE modes that intervene to enhance or diminish their utilization or effectiveness? 4. Is the relationship of CE participation to job performance and professional development affected by the characteristics of the individual, the work or the organization? The answers to these questions will be investigated using a systems model approach. The research will be based on existing longitudinal studies of engineers in six organizations, with follow-up data collected on CE participation, performance and professional development. A path-analytic approach will be used to determine causality. By answering the questions addressed by this research, a guide will be available for organizations to help them determine what changes in their policies and practices can serve to increase the effectiveness and efficiency of their CE programs.

Continuing Education
Development in Science Education
SED78-21864
$69,979
Award date: 09/25/78
Termination: 03/31/81
NSF Program Manager:
Dr. Gene D'Amour

99

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

IMPACT OF MANAGEMENT PRACTICES AND ORGANIZATIONAL CLIMATE ON MOTIVATION OF SCIENTIFIC ENGINEERING PERSONNEL

William A. Snow
Rockwell International
2230 East Imperial Highway
El Segundo, California 90245

This study will analyze the impact management practices have on the motivation of scientific and engineering personnel to participate in certain types of continuing education. It will also analyze the effect the overall organizational climate has on the scientist's and engineer's perception of the importance of continuing education. And the impact of the management practices and organizational climate will be analyzed in terms of the scientific and engineering employees' perceptions of the need for continuing education. The study will include a random sample (3,000) of scientists and engineers from Rockwell International. A climate survey and feedback meetings will be used to obtain the data. The analysis will present the data in percentage distribution terms, using averages of the participants' responses as the basis for the output. These data coupled with the feedback meetings input, will be the basis for responding (in a final report) to the areas being analyzed.

Continuing Education
Development in Science Education
SED78-21944
$39,500
Award Date: 09/25/78
Termination: 03/31/80
NSF Program Manager:
Dr. Gene D'Amour

12/1978

STUDY OF CLE METHODOLOGIES POTENTIALLY TRANSFERABLE TO CESE

Robert J. Smith
Department of Engineering and
Applies Science
University of Wisconsin-Extension
Madison, Wisconsin 53706

A study of Continuing Legal Education (CLE) is proposed. The project is premised on several similarities between CESE and CLE. The study will focus on three different types of CLE providers (e.g., universities, bar associations). One part will seek and identify problems that the CLE providers have encountered and solved. Another part will compare methodologies. The intent is to uncover innovative techniques transferable to CESE, making it more effective and enhancing its quality. The major parts of the study are, in sequence, a literature survey, a mail/phone/on-site survey of selected CLE providers, data analysis, and reporting/dissemination.

Continuing Education
Development in Science Education
SED78-21965
$13,887
Award date: 09/25/78
Termination: 03/31/80
NSF Program Manager:
Dr. Gene D'Amour

101

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

ASSESSMENT OF SCIENTISTS'/ENGINEERS' CONTINUING EDUCATION NEEDS IN SMALL, GEOGRAPHICALLY-DISPERSED INDUSTRIES

W. Sam Adams
University of Wisconsin-Oshkosh
Oshkosh, Wisconsin 54901

Project Objectives: To assess the continuing education needs of scientists and engineers employed in small, geographically-dispersed industries in the central and northern three-quarters of the state of Wisconsin. Also to review the instructional delivery systems of existing continuing education programs and educational materials, facilities, and equipment in use by industry to provide them with opportunities. Finally, to review and recommend changes in existing industry polices on continuing education incentive systems.

Project Activities: Thirty industries will be sampled from the Classified Directory of Wisconsin Manufacturers. Three psychology graduate students, under the supervision of the project director, will interview up to 5 scientists and engineers in each company. A questionnaire will be administered to other scientists and engineers in these same companies. Pre- and post-study conferences will be held with sampled company representatives, engineer and scientist association officers, a UW-Extension representative and continuing education administrators in area higher education institutions.

Continuing Education
Development in Science Education
SED78-21869
$50,124
Award date: 09/25/78
Termination: 03/31/80
NSF Program Manager:
  Dr. Gene D'Amour

12/1978

ASSESSMENT OF SCIENCE EDUCATION IN THE TWO-YEAR COLLEGE (C)

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WASHINGTON, D.C. 20550

CONFERENCE ON THE ASSESSMENT OF SCIENCE EDUCATION IN THE TWO-YEAR COLLEGE

Dr. Richard E. Wilson
American Association of Community
and Junior Colleges
Washington, DC 20036

The purpose of this project is to provide the mechanism by which various local NSF assessment projects in science education across the nation can: (1) improve the usefulness of their assessment reports; (2) better contribute to a comprehensive assessment of science education needs nationally for the community of two-year colleges; (3) allow local assessment principal investigators to share the findings of their projects with other project directors and all other community, junior and technical colleges.

The Foundation's assessment effort includes 36 separate local assessment grants that will produce independent reports near the end of February 1979, and the comprehensive project is expected to analyze data from various existing sources, as well as collect and analyze data from new sources. The NSF advisory committee on two-year college needs assessment forms another part of this effort to determine the science education needs of the nation's two-year colleges.

This project has three components: (1) Planning and Arrangements for a Conference, (2) Holding of Conference, and (3) Preparation of a Summary Report and Dissemination of a Highlight Brochure. The first would involve coordination of the conference with the national meeting of NSF project directors that is scheduled tentatively for February 1979, and with other possible meetings closely related to science education in community, junior and technical colleges. The second would be the conference itself. The third is the preparation of a summary report and dissemination of a highlight brochure to 1,200 two-year colleges.

Two-Year College Assessment Program
Development in Science Education
SED78-26682
$24,200
Award date: 09/26/78
Termination: 06/30/79
NSF Program Manager:
Mr. Bill G. Aldridge

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

LOCAL ASSESSMENT OF SCIENCE EDUCATION IN THE TWO YEAR COLLEGE

Dr. Janan M. Hayes
American River College
Los Rios Community College District
4700 College Oak Drive
Sacramento, California 95841

The goal of this project is to assess the current science program at American River College and to develop recommendations for program and personnel improvement in the science area. The assessment will include a close examination of the changing composition and needs of the student body and an examination of the reactions of faculty to these changes in the student body.

The assessment will include a survey of present students and recent graduates to obtain student evaluations of the current science programs in terms of course content, instructor approach, and resulting attitudes of the students toward the place of science in their lives. In addition, a computer analysis of past trends in student enrollment in individual science classes will be prepared and used to produce projections of future enrollments. We will survey the science faculty on their approach to science instruction and to obtain their evaluation of current science programs. Finally, the results of the two surveys and the projections will be discussed by the science faculty in small discussion groups, facilitated by a consultant. The conclusions of the discussion groups will be compiled into a document which will include statistical data, identified needs, and recommendations for the future.

Two-Year College Assessment Program
Development in Science Education
SED78-09553
$5,000
Award date: 05/24/78
Termination: 02/28/79
NSF Program Manager:
Mr. Bill G. Aldridge

12/1978

LOCAL ASSESSMENT OF SCIENCE EDUCATION IN THE TWO YEAR COLLEGE

Professor Bobbie Jean Nicholson
Brevard College
Brevard, North Carolina 28712

The objectives of this evaluation are: (1) to determine whether biology, chemistry, mathematics, and physics courses at Brevard are comparable in content and depth to those at four year schools where our students transfer, and to survey placement methods at other institutions; (2) to reevaluate our recommended courses including the science course content of the curricula in the area of architecture, computer programming, forestry and conservation, engineering, medicine and veterinary medicine; (3) to compare the placement methods at Brevard with alternative methods of testing and to identify the best placement method(s) in first year biology, chemistry, mathematics, and physics courses; (4) to investigate ways of increasing those verbal skills which are necessary to successful scientific study. Faculty representing each area will personally interview the faculty at senior institutions. A workshop reviewing, summarizing, and evaluating the data will be held using consultants. Reading, English, and mathematics test scores will be compared with our present placement method for math and science. A workshop with consultants on testing will be held.

Two-Year College Assessment Program
Development in Science Education
SED78-09561
$5,000
Award date: 06/06/78
Termination: 03/31/79
NSF Program Manager:
Bill G. Aldridge
12/1978

ANALYSIS OF STUDENT SKILLS, NEEDS AND GOALS

Dean Frank E. Truesdale
Bunker Hill Community College
Rutherford Avenue
Charlestown, Massachusetts 02129

Science course/program selection by students enrolled in urban Community Colleges with open door admission policies generally does not correlate favorably with student needs, interests, and abilities. It is assumed that this low correlation factor contributes significantly to student failures and/or withdrawal from science preparations. We intend to determine: factors which influence student selecting two basic college science courses--Introduction to Natural Environments and Basic Chemistry; factors that influence their success or failure in these courses; how secondary school preparations influence selection and success; sequencing and use of materials and methods to complement interest and preparation of those entering science courses; and counseling and advising practices. Data will be collected from students, faculty, and counselors. Modification of these two courses based on an analysis of the data will be conducted. Courses will be evaluated in the 78-79 academic year to determine the impact on students selecting science courses.

Two-Year College Assessment Program
Development in Science Education
SED78-09682
$5,000
Award date: 06/19/78
Termination: 05/31/79
NSF Program Manager:
Mr. Bill G. Aldridge

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

LOCAL ASSESSMENT OF SCIENCE EDUCATION IN THE TWO-YEAR COLLEGE

Prof. Charles Allbee
Burlington County College
Pemberton-Brown Mills Road
Pemberton, New Jersey 08068

Project PLAN has the goal of developing a prototypic model for assessing social science disciplines at Burlington County College. Specific objectives include identification of political science topics and educational experiences that will be most meaningful to students, the development of an understanding of market needs for political science in a liberal education and the preparation of a needs assessment document.

The assessment project will include a report on the current status of political science at BCC, a survey of students and employers to identify meaningful topics and market needs, and the compilation of information on political science programs at other community colleges.

Anticipated outcomes include a model for assessing other social science disciplines at BCC, a plan for improving the political science curriculum and an assessment of what will be required to accomplish the development plan.

Two-Year College Assessment Program
Development in Science Education
SED78-09848
$5,000
Award date: 06/13/78
Termination: 02/28/79
NSF Program Manager:
Mr. Bill G. Aldridge

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

LOCAL ASSESSMENT OF SCIENCE EDUCATION IN THE TWO YEAR COLLEGE

Professor Robert L. Sawyer
Catonsville Community College
800 South Rolling Road
Catonsville, Maryland 21228

The project objective is identification of strengths and weaknesses of science education at CCC. The anticipated outcome would be a reassignment of budget priorities at CCC to offset those weaknesses. The current status of the disciplines of chemistry, earth sciences, engineering, life sciences, mathematical sciences, physical sciences, physics, psychology and social sciences will be assessed. Catalog inspection, outside consultation, student questionnaires, faculty questionnaires, administrative questionnaires, registrar's reports, and budgets will be used in the assessment. The questionnaires will be developed and validated by a faculty committee with three college divisions: Engineering and Mathematics, Natural Science, and Social Science. Analysis of the data will be carried out by a committee consisting of the Dean of Instruction and the three division chairpersons.

Two-Year College Assessment Program
Development in Science Education
SED78-09562
$5,000
Award date: 06/12/78
Termination: 03/31/79
NSF Program Manager:
Bill G. Aldridge
12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON. D.C. 20550

LOCAL ASSESSMENT OF SCIENCE EDUCATION IN THE TWO YEAR COLLEGE

Professor Donald Fama
Cayuga County Community College
Auburn, New York 13021

1. Statement of Objectives: The intended project will thoroughly investigate the present program in Engineering Science by means of curriculum evaluation, assessment of industrial perspective, transfer analysis of graduates, laboratory assessment, and assessment of participation of women and minorities in engineering science.

2. Project Description: The assessment will be carried out by engineering faculty, an industrial consultant, and a representative from a transfer institution.

Anticipated outcomes include: (1) identification of major curricular weaknesses; (2) identification of job skills and educational requirements of local industry; (3) improvement in course offerings; (4) incorporation of student feedback in future planning; (5) improvement of employment prospects for our graduates; (6) establishment of a separate engineering science laboratory as an integral part of the Engineering Science program; and (7) achievement of an increase in the number of women and minorities in the Engineering Science program.

Two-Year College Assessment Program
Development in Science Education
SED78-09666
$4,200
Award date: 06-06-78
Termination: 02-28-79
NSF Program Manager:
Bill G. Aldridge

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

ASSESSMENT OF A CHANGE TO A MODULARIZED APPROACH TO SCIENCE INSTRUCTION

Dr. Faustine Perham
Central YMCA Community College
211 W. Wacker Drive
Chicago, Illinois 60606

An assessment study will be conducted to determine the feasibility of developing and implementing a modularized, self-paced instructional approach to courses in the Natural Science Department at CYCC, particularly for BIO 101 and PHY 205. The assessment plan would train science faculty in the techniques of assessment, use of survey questionnaires, and use of mastery learning and open-laboratory techniques. It would give released time to two faculty members to prepare and distribute questionnaires to faculty and students on current instructional strengths and weaknesses, to compile data from research studies at other institutions on use of mastery learning and open-lab instruction, and to hold discussions with faculty on data collected and on recommendations for or against implementation. If consensus is positive, the two instructors will suggest alternative plans for modularizing BIO 101 and PHY 205 in conjunction with an open-lab approach. The assessment will test the hypothesis that a modularized, open-laboratory approach would be feasible in terms of personnel, time, space, and cost, and that such an approach would be beneficial to our students in terms of significantly increased learning.

Two-Year College Assessment Program
Development in Science Education
SED78-09758
$5,000
Award date: 06/22/78
Termination: 04/30/79
NSF Program Manager:
Mr. Bill G. Aldridge

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

APPRAISAL OF CURRENT SCIENCE EDUCATION AT A DEVELOPING COMMUNITY COLLEGE

Dr. Richard A. Dodge
Cerro Coso Community College
College Heights Boulevard
Ridgecrest, California 93555

The project will assess and evaluate the current status of science education at Cerro Coso Community College. A project team of the entire science faculty will critically review transfer science programs, the relation of science education programs to science based technical programs, and the continuing education needs of local scientists. The anticipated result is a planning document which will define science education needs and enhance the institution's capability for continued evaluation of science education.

Two-Year College Assessment Program
Development in Science Education
SED78-09676
$5,000
Award date: 05/30/78
Termination: 02/28/79
NSF Program Manager:
Mr. Bill G. Aldridge

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

SCIENCE EDUCATION IN THE NON-CAMPUS COLLEGE: A NEEDS ASSESSMENT

Dr. Edward Decker
Coastline Community College
of the Coast Community College District
10231 Slater Avenue
Fountain Valley, California 92708

A needs assessment survey of students, faculty and science industries will be conducted in the Coast Community College District to determine the courses, programs and life-long learning needs of the adult student in the non-campus college setting. Methodology will include mail surveys, intensive interviews and a literature search. The final report will address program needs and educational delivery systems appropriate to a "college without a campus" which serves over 40,000 different students each year.

Two-Year College Assessment Program
Development in Science Education
SED78-09683
$5,000
Award date: 05/22/78
Termination: 02/28/79
NSF Program Manager:
Mr. Bill G. Aldridge

12/1978

ASSESSMENT OF SCIENCE EDUCATION AT COWLEY COUNTY COMMUNITY COLLEGE

Professor Mike Watters
Cowley County Community College
125 South Second Street
Arkansas City, Kansas 67005

The Department of Natural Sciences of Cowley County Community College will carry out a comprehensive evaluation of all four disciplines in the department (biology, chemistry, mathematics, and physics). Each discipline will be evaluated for status of curricula, programs, and courses, and the needs for new or modified curricula and courses. All lab courses will be evaluated for suitability of current activities, facilities, and apparatus. With the technical assistance of outside consultants and input from all parts of the college community, the department also proposes to gain local expertise in evaluation and develop a plan of improvement. The total assessment should provide an adequate basis for long-range planning and management to insure greater program relevancy, more cost-effectiveness, better utilization of existing resources, and development of additional resources.

Two-Year College Assessment Program
Development in Science Education
SED78-09564
$5,000
Award date: 07/11/78
Termination: 05/31/79
NSF Program Manager:
Bill G. Aldridge

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

LOCAL ASSESSMENT OF SCIENCE EDUCATION IN THE TWO-YEAR COLLEGE

Prof. Billie Ann Rice
DeKalb Community College
555 North Indian Creek Drive
Central Campus, Math Dept.
Clarkston, Georgia 30021

Man learns by doing, seeing, and hearing in that order. When the student is programmed to listen to the teacher and watch the board, he is not receiving the most efficient mode of instruction. Students may learn not only from a teacher giving a lecture before the class, but also by using multi-media learning materials and through a variety of experiences that may be coordinated by the teacher. Teachers of mathematics should become aware of their own weaknesses as well as student deficiencies and alter the traditional approach to certain mathematical concepts, thus interrupting the "status quo cycle."

This project is designed to search for teacher weaknesses and identify major student deficiencies by using a carefully planned testing procedure, including the math lab and the classroom experiences. After the data are compiled and priority problem areas are identified, the faculty will be informed of available multi-media material that might offer possible solutions in the problem areas. Help will also be requested from our Faculty Development Committee and available consultants within the area.

Two-Year College Assessment Program
Development in Science Education
SED78-09847
$5,000
Award date: 06/15/78
Termination: 04/30/79
NSF Program Manager:
Mr. Bill G. Aldridge

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

LOCAL ASSESSMENT OF SCIENCE EDUCATION IN THE TWO YEAR COLLEGE

Mr. Edward A. Ochoa
El Paso County Community College
6601 Dyer Street
El Paso, Texas 79904

This project will (1) examine the relationship of curriculum content to existing and planned program needs, (2) examine the need for new courses in the sciences, (3) examine the relationship of developmental and remedial offerings and existing and planned courses, (4) examine the integration of laboratory work with classroom instruction, and (5) examine the current status and use of laboratories at El Paso County Community College. These activities are to be carried out by an instructional development team with the aid of consultant input.

Two-Year College Assessment Program
Development in Science Education
SED78-09691
$5,000
Award date: 05/30/78
Termination: 02/28/79
NSF Program Manager:
Mr. Bill G. Aldridge

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

ASSESSING THE BIOLOGICAL SCIENCE NEEDS OF COMMUNITY COLLEGE FRESHMEN

Prof. Donald S. Emmeluth
Fulton-Montgomery Community College
Route 67
Johnstown, New York 12095

In order to prepare a needs assessment evaluation report, we will assess the biological science needs of incoming student groups in terms of: a. entering behaviors; b. needs as determined by local institution instructors; and c. exit needs as determined by consultants from transfer institutions and appropriate industries. By means of interviews, diagnostic testing and analysis of course curriculum information we will compare and contrast these student needs with our existing course offerings and determine if a new system of modular courses is necessary to meet the needs of our diverse student population.

Two-Year College Assessment Program
Development in Science Education
SED78-09893
$4,800
Award date: 06/13/78
Termination: 02/28/79
NSF Program Manager:
Mr. Bill G. Aldridge

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

LOCAL ASSESSMENT OF SCIENCE EDUCATION IN THE TWO YEAR COLLEGE

Dr. Martha T. Hatcher
Gainesville Junior College
Gainesville, Georgia 30501

A document will be prepared to indicate the status of the Audiotutorial Biology Laboratory after ten years of continuous operation on this campus. When completed and disseminated this document will be a tool for assessment of the strengths and weaknesses of the present operation and will provide a resource for future decision making for renewal, upgrading and updating the operation. The development of a systematic and routine plan for the assessment will aid in the management of data presently on hand and that to be accumulated as a continuing process of evaluation. Evaluations will be made on the basis of information gathered from students, faculty and external consultants.

Two-Year College Assessment Program
Development in Science Education
SED78-09673
$4,400
Award date: 06/07/78
Termination: 02/28/79
NSF Program Manager:
Mr. Bill G. Aldridge

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

LOCAL ASSESSMENT OF SCIENCE EDUCATION IN THE TWO-YEAR COLLEGE

Mr. William F. Hibschman
401 Thomas Run Road
Harford Community College
Bel Air, Maryland 21014

To determine if students at Harford Community College are getting the best science education possible through the most up-to-date equipment, computer facilities, and audiovisual support, a comprehensive assessment of these areas will be undertaken. An in-depth analysis of instructional support will be performed utilizing faculty members, technical assistants and outside consultants. A final report will be published containing recommendations to correct weaknesses and capitalize on strengths discovered during the assessment. This report will be delivered to the College president and, additionally, will serve as a plan for improvement of instruction within the Scientific Studies Division.

Two-Year College Assessment Program
Development in Science Education
SED78-09839
$5,000
Award date: 06/19/78
Termination: 02/28/79
NSF Program Manager:
Mr. Bill G. Aldridge

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

SCIENCE FOR THE NON-SCIENCE STUDENT AT ILLINOIS CENTRAL COLLEGE: AN ASSESSMENT OF SCIENCE NEEDS FOR COMMUNITY COLLEGE STUDENTS

Dr. Thomas C. Campbell
Illinois Central College
Box 2400
East Peoria, Illinois 61635

Recent science area enrollment fluctuations at ICC have prompted faculty and administration concern. While Biology and Chemistry enrollments have remained steady in a declining student population, Earth Science enrollments have increased dramatically and Physical Science enrollments have dropped significantly. These courses are maintained especially for the non-science majors.

This project has two primary areas of inquiry. First, what is the distribution of enrollment of non-science majors in introductory science courses and who influences students in their choice of enrollment. Second, how does the course choice fit the perceived needs of the student in terms of his learning style, demands made on his reasoning ability, or how the content fits his career choice. The final analysis of this information will act as a base line in making science courses designed for the non-science major more attractive and attuned to students' needs.

Two-Year College Assessment Program
Development in Science Education
SED78-09672
$5,000
Award date: 06/22/78
Termination: 04/30/79
NSF Program Manager:
Mr. Bill G. Aldridge

12/1978

LOCAL ASSESSMENT OF SCIENCE EDUCATION IN THE TWO YEAR COLLEGE

Ms. Lena Dexter
James H. Faulkner State Junior College
Bay Minette, Alabama 36507

The objectives of this proposal are: (a) to examine the design and effectiveness of the existing mathematics courses for the non-science major; (b) to examine the design and effectiveness of the beginning level mathematics courses for the science major; (c) to determine the specific strengths and weaknesses of the students who enroll in these courses; and (d) to prepare a strategy for improving both types of courses in order to more effectively match curriculum content and teaching methodology to the students' ability level. The project director will direct a nine month study to achieve these objectives, utilizing input from department members, assistance from selected consultants, visitations to successful programs at similar institutions, and institutional research. It is anticipated that the successful completion of the project will result in a strengthened curriculum, a higher student success rate, and improved teaching methods.

Two-Year College Assessment Program
Development in Science Education
SED78-09686
$5,000
Award date: 06/23/78
Termination: 03/31/79
NSF Program Manager:
Mr. Bill G. Aldridge

12/1978

LOCAL ASSESSMENT OF SCIENCE EDUCATION IN THE TWO YEAR COLLEGE

Mr. G. Elliott Tyler
John C. Calhoun State Community College
Decatur, Alabama 35602

This project will carry out a comprehensive needs assessment for the Division of Natural Science, Mathematics, and Engineering. The assessment will identify in priority order the items or activities essential to meet the institution's goals.

The specific subject areas to be covered include biological science, physical science, chemistry, physics, mathematics, pre-engineering, electronic engineering technology, industrial engineering, and mechanical engineering technology.

The three Department Chairmen in the Division will actively participate in the needs assessment.

The needs assessment will cover every phase of operations in the Division, including the need for faculty, for instructional equipment, for instructional supplies, for faculty training, for student financial aid, for an honors program for students, for tutoring, for secretarial assistance, for lab assistants, for classroom and lab space, for offices, office furniture and office supplies, for distribution of teaching load, for released time for curriculum improvement, and for strengthening instruction. The final report will serve as a part of the long-range plan of the College since it will show how the Division can be strengthened over the next several years.

Two-Year College Assessment Program
Development in Science Education
SED78-09677
$5,000
Award date: 06/06/78
Termination: 03/31/79
NSF Program Manager:
Mr. Bill G. Aldridge

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

LOCAL ASSESSMENT OF SCIENCE EDUCATION IN THE TWO YEAR COLLEGE

Mr. Robert Ernst
Kirkwood Community College
P. O. Box 2068
Cedar Rapids, Iowa 52406

The purpose of this project is to enhance the curriculum of Kirkwood Community College's Math/Science Department through assessment of the appropriateness of science education at Kirkwood as perceived by its college parallel transfer student. A needs assessment survey will be developed and conducted with students currently or previously (1971-74) enrolled as college parallel transfer candidates.

The survey data will be analyzed and a final report detailing identified program curricula needs produced.

Two-Year College Assessment Program
Development in Science Education
SED78-09552
$5,000
Award date: 05/30/78
Termination: 02/28/79
NSF Program Manager:
Mr. Bill G. Aldridge

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

LOCAL ASSESSMENT OF SCIENCE EDUCATION IN THE TWO YEAR COLLEGE

Dr. William J. Lembeck
Louisiana State University at Eunice
Eunice, Louisiana 70535

A needs assessment of Drafting and Design Technology, a two-year associate degree program for training engineering technologists, will be conducted using a context evaluation model. This program should be attracting larger numbers of students since it is located in an industrial and natural resource-based area. The goal of the assessment is to increase the pool of potential students and possible areas of employment. Previous graduates will be interviewed to determine program relevance. Regional employers will be polled to specify employment characteristics. Academic and industrial consultants will be employed to obtain detailed judgments regarding goals, curriculum and needed resources. Based on this assessment, a series of recommendations to upgrade the program will be made.

Two-Year College Assessment Program
Development in Science Education
SED78-09663
$5,000
Award date: 06/01/78
Termination: 02/28/79
NSF Program Manager:
Mr. Bill G. Aldridge

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

AN INVESTIGATION OF THE APPLICABILITY OF COMPUTER ASSISTED INSTRUCTION IN THE SOCIAL SCIENCE DIVISION OF MONTEREY PENINSULA COLLEGE

Mr. Bela Banathy
Monterey Peninsula College
Monterey, California 93490

Monterey Peninsula College proposes to involve four faculty members in an investigation of computer aided instruction and its potential impact on the Social Science faculty and their students. The project is also designed to lead to some more general conclusions about the effectiveness of social sciences training at M.P.C.

Findings of the study will be reported to NSF and the ERIC Community College Clearinghouse at UCLA.

Two-Year College Assessment Program
Development in Science Education
SED78-10360
$5,000
Award date: 05/22/78
Termination: 02/28/79
NSF Program Manager:
Mr. Bill G. Aldridge

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

LOCAL ASSESSMENT OF SCIENCE EDUCATION IN THE TWO YEAR COLLEGE

Professor Clifford D. Miller
Mountain View College
4849 W. Illinois
Dallas, Texas 75211

A Task Force will investigate the need for applied chemistry in sixteen career occupation programs offered at Mountain View College of the Dallas County Community College District (DCCCD). The principal investigator, aided by knowledgeable in-house personnel in each of the sixteen programs and qualified consultants from Advisory Boards will conduct an in-depth study of the present chemistry curriculum for technical students. Areas for assessment include needs for new or modified curricula, student problems or needs, areas in which no written instructional material exists, areas where new lab activities are needed, areas where faculty knowledge is outdated or in which faculty has knowledge gaps.

Project Objectives:

1. To appraise the current status of chemistry in career occupation programs.
2. To determine institutional needs in a new career occupation program in chemical technology.
3. To recommend content, methods, materials, and faculty development for a chemistry program at Mountain View that meets identified needs.

Two-Year College Assessment Program
Development in Science Education
SED78-09555
$5,000
Award date: 05/24/78
Termination: 06/30/79
NSF Program Manager:
Mr. Bill G. Aldridge

12/1978

LOCAL ASSESSMENT OF SCIENCE EDUCATION IN THE TWO-YEAR COLLEGE

Prof. Everett G. House
Nashville State Technical Institute
120 White Bridge Road
Nashville, Tennessee 37209

Nashville State Technical Institute will do an intensive needs assessment of certain developmental mathematics courses. These courses are offered to correct the mathematical deficiencies of the weaker engineering technology student. The placement testing program and the success rate of engineering technology students needing developmental mathematics compared to those that do not will be researched and investigated. Based upon the suspected problem areas of the developmental mathematics program, survey instruments will be utilized to solicit the opinions of administrators, faculty, and students. Consultants will be used to help construct the survey instruments, to establish statistical procedures, and to analyze the responses. Strengths and weaknesses of the program will be identified and ranked. The conclusions drawn from this study will become a basis for constructive changes in the program. Plans for future action will be developed.

Two-Year College Assessment Program
Development in Science Education
SED78-09845
$5,000
Award date: 06/07/78
Termination: 02/28/79
NSF Program Manager:
Mr. Bill G. Aldridge

12/1978

STUDENTS, CURRICULA AND LABORATORIES - A NEEDS ASSESSMENT

Mr. Malcolm Nason
North Shore Community College
Beverly, Massachusetts 01915

The project consists of a needs assessment in the main goal areas of student needs/weaknesses; course offerings; laboratory facilities and equipment; and in-service faculty development. The starting point for the project involves student need/weaknesses. It has become apparent over the past several years that the ability levels and thus the needs of students in the two-year community colleges have significantly changed. It is our intent to analyze these weaknesses/needs and respond to them by modifications in science courses (curricula), laboratory facilities, equipment, supplies, and faculty in-service development. An acceptable state of affairs in each area will be defined and a prioritized needs assessment developed from a consistent rating scale. The self-assessment will be conducted by a faculty task-force. The acceptable state of affairs, rating scale and needs assessment will be determined through workshops and meetings involving the faculty task-force, an external task-force and an external consultant in two-year community college science education. The final needs assessment in the goal areas will take the form of a prioritized listing of needs documented with observed and defined acceptable state of affairs, appropriate rating scale information and recommendations on how best to satisfy needs.

Two-Year College Assessment Program
Development in Science Education
SED78-09565
$5,000
Award date: 05-22-78
Termination: 02-28-79
NSF Program Manager:
Bill G. Aldridge

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

LOCAL ASSESSMENT OF SCIENCE EDUCATION IN THE TWO YEAR COLLEGE

Dr. George G. West
Northern Virginia Community College
Alexandria, Virginia 22311

Decreases in enrollment, increases in the drop-out rate, and duplication of content among major natural science courses at the Alexandria Campus of Northern Virginia Community College indicate the need for an assessment to ascertain if instruction is responsive to the diverse goals of its students and the extent to which it promotes effective learning. Fortunately, the campus possesses a powerful instructional resource in TICCIT, a computer-assisted instruction system. TICCIT has been in use for three years at the Alexandria Campus and has resulted in increased student achievement. It is proposed that an assessment of major natural science courses be made by means of faculty interviews and student questionnaires to identify problem areas; that a match be sought between these areas and various instructional strategies that can be implemented on TICCIT; that the most feasible of these TICCIT strategies be selected and incorporated in an action plan for the production and implementation of new TICCIT material; that problems not amenable to solution through the use of TICCIT be flagged for further analysis; and that this campus utilize the action plan to improve science education.

Two-Year College Assessment Program
Development in Science Education
SED78-09665
$4,770
Award date: 06-13-78
Termination: 08-31-79
NSF Program Manager:
Bill G. Aldridge

12/1978

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LOCAL ASSESSMENT OF SCIENCE EDUCATION IN THE TWO-YEAR COLLEGE

Dr. Martha W. Sellers
Northern Virginia Community College
8333 Little River Turnpike
Annandale, Virginia 22003

This project proposes to undertake a needs assessment of the two year program in chemistry at the Annandale Campus of Northern Virginia Community College. From May to September 1978 one faculty member project director with the help of three other faculty members, and clerical and secretarial staff is to accomplish the following: Assess the present situation with respect to chemical education at this College Campus and compare it with other Colleges; identify deficiencies in counselling of prospective students, course management, course content, supplementary materials and lab exercises; and recommend measures to alleviate deficiencies.

Two-Year College Assessment Program
Development in Science Education
SED78-09841
$5,000
Award date: 06/13/78
Termination: 03/31/79
NSF Program Manager:
Mr. Bill G. Aldridge

12/1978

CHEMISTRY AND BIOLOGY LABORATORY FACILITIES AND CURRICULA

Professor Edward Eagan
Quinsigamond Community College
670 West Boylston Street
Worcester, Massachusetts 01606

This project will examine the needs for laboratory facilities renovation and construction and for curriculum development in chemistry and biology at the college. There are currently two laboratories which are used for five different chemistry and biology courses. This results in overcrowding, overutilization, and health and safety problems. Lack of facilities also bars a number of other chemistry and biology courses from offering laboratory experiences and instruction. The results of this project will provide invaluable input to the college's master planning efforts and will enable the college to most effectively utilize the limited funds available to renovate existing laboratories and construct new facilities. The project will also address needs for curriculum development in chemistry and biology, specifically examining the needs for an organic chemistry course, an audio-tutorial anatomy and physiology course. It will identify ways in which current curricula can be revised to better serve students who have language and skill deficiencies or who are physically handicapped or learning disabled.

Two-Year College Assessment Program
Development in Science Education
SED78-09558
$5,000
Award date: 06/23/78
Termination: 03/31/79
NSF Program Manager:
Mr. Bill G. Aldridge

12/1978

THE NEXT STEP: A COMPUTER FACILITIES MASTER PLAN FOR SADDLEBACK

Professor Dave Campbell
Saddleback College
28000 Marguerite Parkway
Mission Viejo, California 92692

The goal of this assessment is to develop a master plan for the expansion of the Saddleback College instructional computer facility. After assessing current and future curriculum needs and examining alternatives, a determination of the prudent course will be made. Recommendations will be submitted to the administration and Board of Trustees for adoption as part of the instructional facilities master plan. The assessment will consist of six steps: (1) evaluation of existing facilities, (2) in-depth discussions with potential users within the college community to determine future needs, (3) evaluation of current facilities at nearby colleges, (4) discussions with competing computer system vendors, (5) an analysis of funding alternatives, and (6) final report with specific recommendations. This report will be widely distributed, and follow-up open meetings with staff, faculty, administrators and the Board of Trustees will be scheduled to discuss and defend the team's conclusions. Once adopted, the plan will be implemented.

Two-Year College Assessment Program
Development in Science Education
SED78-09687
$5,000
Award date: 06/05/78
Termination: 02/28/79
NSF Program Manager:
Mr. Bill G. Aldridge

ASSESSMENT OF MATHEMATICS PROGRAM AT S. D. BISHOP STATE JUNIOR COLLEGE

Dr. Roy Daigle
S. D. Bishop State Junior College
351 North Broad Street
Mobile, Alabama 36603

The mathematics curriculum at S. D. Bishop State Junior College will be assessed to determine if there are needs to:

1. restructure the Basic College Algebra sequence to conform to present and future needs of students in General Education;
2. combine two mathematics courses into one institutional credit course to strengthen the mathematics background of the transfer student in General Education;
3. change the present structure of the technical mathematics course to conform to the area of study;
4. change the topic offerings in the mathematics course for the medical technical transfer student; and
5. introduce the computer into the College Algebra course to strengthen and improve the mathematical backgrounds of the students in Science, Mathematics, and Engineering.

Two-Year College Assessment Program
Development in Science Education
SED78-09685
$5,000
Award date: 05/22/78
Termination: 02/28/79
NSF Program Manager:
  Mr. Bill G. Aldridge

12/1978

LOCAL ASSESSMENT OF SCIENCE EDUCATION IN THE TWO YEAR COLLEGE

Mr. Robert King
Southeastern Community College
Whiteville, North Carolina 28472

The major objective of this proposal is to develop a needs assessment document for placement of students in Science courses. The project plan includes: 1) Identification of goal areas; 2) Selection and development of measures for these goals; 3) Selection of acceptable levels on the measures; 4) Administration of the measures; 5) Comparision of observed levels with acceptable levels; 6) Assignment of priorities among needs for the purpose of defining action programs; and 7) Determination of the feasibility of initiating programs to eliminate need. The anticipated outcomes of this project are more accurate placement of students in Science courses according to their needs and learning levels by: 1) Identification of freshmen who are below the acceptable level for beginning Science courses; and 2) Determination of what instructional methods, learning experiences, and required resources best carry the content for students placed in the developmental courses.

Two-Year College Assessment Program
Development in Science Education
SED78-09670
$5,000
Award date: 06/06/78
Termination: 03/31/79
NSF Program Manager:
Mr. Bill G. Aldridge

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

SUOMI COLLEGE SCIENCE EDUCATION ASSESSMENT PROJECT

Mr. Donald Wanhala
Suomi College
Hancock, Michigan 49930

The objectives of Suomi College's Science Education Assessment Project are to assess the major problems associated with biology laboratory instruction, to identify alternative solutions by which the problems may be addressed, and to produce the assessment document that presents the project's findings and recommendations for improvement of the biology program.

The project plan involves assessing laboratory and library facilities, conducting interviews, identifying alternative plans for solving the problems, and evaluating the alternatives and producing an assessment document.

The outcomes that are anticipated from this assessment project are two-fold: first, the college will learn how better to introduce biology students to the scientific method by improved laboratory instruction, and second, this project will provide a model that can be utilized to enhance other science areas.

Two-Year College Assessment Program
Development in Science Education
SED78-09689
$4,800
Award date: 06/09/78
Termination: 02/28/79
NSF Program Manager:
Mr. Bill G. Aldridge

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

TRITON'S COMPREHENSIVE SELF-ASSESSMENT OF SCIENCE EDUCATION

Mr. William Collien
Triton College
2000 Fifth Avenue
River Grove, Illinois 60171

A comprehensive, systematic appraisal of course content and computer-assisted instruction in Biological Science, Chemistry, Engineering/Physics, and Physical Science will be conducted during the Fall '78. The objectives of the project are:

1. To determine the overall adequacy of course offerings for achieving the mission and goals of the college in all areas of science education.
2. To assess the desirability of computer-assisted and/or computer-managed instruction at Triton College.
3. To develop a rational basis for decision-making in the areas studied.
4. To improve the quality and availability of science education at Triton College.
5. To prepare an assessment document which will provide useful information on the overall status and needs of science education in the two-year college.

The assessment will be conducted by specialized task forces which will involve all full-time Science/Engineering staff. The task forces will conduct an inventory of the current status of science education, assess the adequacy of the college's efforts, and recommend changes which are needed to meet the needs of students for science education. The assessment document will be utilized for planning and change to improve the efficiency and effectiveness of science education at Triton College.

Two-Year College Assessment Program
Development in Science Education
SED78-09846
$5,000
Award date: 06/02/78
Termination: 02/28/79
NSF Program Manager:
Mr. Bill G. Aldridge

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

LOCAL ASSESSMENT OF SCIENCE EDUCATION IN THE TWO YEAR COLLEGE

Dr. Timothy I. Edwards
Wake Technical Institute
Route 10 Box 200
Raleigh, North Carolina 27605

Wake Technical Institute conducts six (6) engineering technology programs leading to the Associate in Applied Science Degree. The programs were initiated between 1964 and 1969 and were initially accredited in 1972 and reaffirmed in 1976 by the Engineers' Council for Professional Development.

The project goal is to assess the scientific and mathematical subject matter in the six (6) engineering technology programs. The principal investigator will convene a faculty study-group which will identify topics in question and develop ways and means (including an instrument) to assess those topics. The instrument will be validated by mailing to engineering technology educators. The instrument will then be mailed to Wake Tech graduates and their employers.

The project will be conducted during the summer of 1978. At the conclusion of the study, a report will be produced which identifies the subject areas most needed in each engineering technology program and the subject areas least needed. The final result will provide the basis for possible changes in the scientific and mathematical topics and instructional methodology used in the six (6) engineering technology programs at Wake Technical Institute.

Two-Year College Assessment Program
Development in Science Education
SED78-09674
$5,000
Award date: 06/09/78
Termination: 03/31/79
NSF Program Manager:
Mr. Bill G. Aldridge

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

LOCAL ASSESSMENT OF SCIENCE EDUCATION IN THE TWO YEAR COLLEGE

Dr. John T. Collins
Dr. John N. Sarrubbo
Westchester Community College
75 Grasslands Roads
Walhalla, New York 10595

Westchester Community College is a two year community college under the auspices of SUNY. The college currently offers two year associate degrees in Civil, Electrical and Mechanical Technology and Engineering Science. For the past several years, approximately 50% of the graduates from the three technical areas and almost all of the Engineering Science graduates have transferred to four year institutions. This transfer percentage for the technical areas (basically occupational oriented programs) is approximately three times the national average, and while it speaks well for the caliber of the student and the college, it poses problems in meeting the changing needs of the college students. The relatively small number of students from the three technical areas, 110 students per year, reduces the practicality of establishing parallel programs (occupational-transfer) in the three disciplines. The current programs have been structured to satisfy the needs of the non-transfer students. The needs of transferring student have been recognized and addressed within the existing structure using math electives. However, thorough evaluation has never been undertaken to determine the efficiency of the combined transfer and career program. This study will make this evaluation by (1) surveying graduates and transfer institutions to obtain the necessary data, (2) analyzing and summarizing the data, (3) reviewing and making recommendation for appropriate revisions of math, physics and engineering components of the curricula, (4) making specific recommendations for implementation and possible ECPD accreditation.

Two-Year College Assessment Program
Development in Science Education
SED78-09671
$4,800
Award date: 06/13/78
Termination: 02/28/79
NSF Program Manager:
Mr. Bill G. Aldridge

12/1978

NATIONAL SCIENCE FOUNDATION
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STUDY OF SCIENCE EDUCATION IN TWO-YEAR COLLEGES

Dr. Lance Hodes
Westat, Inc.
Rockville, Md. 20852

The purpose of this project is to identify the role of two-year colleges in science education and the extent to which they fulfill that role. The results are expected to provide a basis for understanding of the functions, programs, and teaching methodologies of the two-year colleges. For this assessment the audience will include two-year colleges, their professional organizations, the NSF and other government agencies at Federal and State levels.

The study will gather information from a sample of 200 institutions across the country, requesting responses from 1,000 faculty members, 4,000 students and 200 school administrators. In addition, results from two NSF-supported program efforts--the U.C.L.A. study of courses and instructional practices, and the needs assessment of 36 institutions funded under the Local Assessment of Science Education in the Two-Year College program--will be analyzed and integrated into the study.

This project will ascertain needs in areas of faculty development, institutional resources and support, and programs and courses. In contrast, the U.C.L.A. project concentrates on the status of science education in terms of courses and teaching methodology.

Two-Year College Assessment Program
Development in Science Education
SED78-21054
$190,734
Award date: 09/30/78
Termination: 03/31/80
NSF Program Manager:
Mr. Bill G. Aldridge

12/1978

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WASHINGTON, D.C. 20550

EVALUATION AND NEEDS ASSESSMENT FOR MATHEMATICS EDUCATION

Mr. William J. Bonini
Western Wyoming Community College
Box 428
Rock Springs, Wyoming 82901

An extensive evaluation of the discipline of mathematics--how it is being taught, effectiveness of courses, qualifications of instructors, transferability of courses, and staffing requirements--will be conducted at Western Wyoming Community College.

The project will use a mathematics consultant, present mathematics staff, present and former students, comparisons to other similar institutions, input from other departments within the College, and input from a 14 member industrial association.

The assessment report will include statistical conclusions derived from each source and will be used in planning mathematics education at Western Wyoming Community College.

Two-Year College Assessment Program
Development in Science Education
SED78-09559
$5,000
Award date: 06/13/78
Termination: 02/28/79
NSF Program Manager:
Bill G. Aldridge

12/1978

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LOCAL ASSESSMENT OF SCIENCE EDUCATION IN THE TWO-YEAR COLLEGE

Dr. John S. DiYorio
Wytheville Community College
1000 East Main Street
Wytheville, Virginia 24382

The science disciplines at Wytheville Community College have reached a point in their development where serious consideration of current practices and future operations is required. Although the number of full-time students enrolled in the College is leveling off, science disciplines are faced with requests for growing numbers of support courses from various curricula offered by the College. In addition there is a growing need to update the basic biology, chemistry and physics courses offered to science majors within the Science Curriculum. This project, through the use of outside consultants and the study of outside "model" programs, will assess current operating procedures within the science disciplines and the Science Curriculum. A report will be prepared containing:

(a) a discussion of weaknesses in the science offerings and Science Curriculum;

(b) recommendations for revision to meet current instructional responsibilities;

(c) a projection of future instructional and physical facility requirement

Two-Year College Assessment Program
Development in Science Education
SED78-09842
$5,000
Award date: 06/02/78
Termination: 02/28/79
NSF Program Manager:
Mr. Bill G. Aldridge

12/1978

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COMPUTER ASSISTED SCIENCE EXHIBITS

Dr. W. M. Laetsch
Lawrence Hall of Science
University of California
Berkeley, California 94720

The fundamental question addressed in this research is this: to what extent can one deliberately structure an individual's experience with a science exhibit so as to increase cognitive outcomes without sacrificing the attractiveness of the exhibit? Experience with computers as exhibits in their own right in science and technology centers gives strong evidence that a participatory "computer assisted science exhibit" would both teach more effectively and be more attractive than a passive exhibit. The methodology to be used, therefore, is one of physically integrating stand-alone microcomputers into three existing public exhibits at the Lawrence Hall of Science. The computers will control the variables to be manipulated by the individual, and will monitor the relevant physical variables that indicate the instantaneous state of the exhibit. The research design will vary independently the degree of instructional structure in a set of CAI programs in the computers and will measure as independent variables the visitor's cognitive gains and the attractiveness of the exhibits. The methods developed in this research will be disseminated to science centers and others, who will be able to make science exhibits into effective educational systems within settings which visitors consider informal and attractive. The 40 million annual visitors to science centers form the principal target population that would be affected by the results of this research.

Research in Science Education
SED78-17543
$190,112
Award Date: 09-15-78
Termination: 02-28-81
NSF Program Manager:
Dr. Andrew Molnar

A RESEARCH EVALUATION OF SCIENTIFIC REASONING ABILITY IN NATURALISTIC AND LABORATORY SETTINGS

Dr. W. M. Laetsch
University of California
Berkeley, California 94720

The research is concerned with evaluating the impact of classroom science on everyday decision-making and determining how educational programs could be modified to have a greater effect on everyday decision-making. Scientific reasoning or the ability to recognize uncontrolled experiments and design controlled investigations was chosen for study because so many decisions involve either considering results of uncontrolled experiments or designing controlled experiments.

As recently suggested by Robert Glaser (1976) the research plan could be described as selecting an important problem (the generalization of scientific reasoning ability) and developing a solution guided by the latest developments in cognitive theory especially the information processing paradigm. One aspect of the proposed research will be to provide a model of how a linking structure can be developed. The procedure is to carry out 11 experiments using seventh, ninth, and eleventh grade boys and girls in three different socio-economic areas to (1) evaluate scientific reasoning in laboratory settings, naturalistic settings, informal activities, and games, (2) investigate variables which might account for discrepancies between naturalistic and laboratory performance, (3) design and compare two training procedures, one to teach scientific reasoning concepts and another to show how to apply the concepts to new problems, and (4) to assess the role of individual differences on scientific reasoning ability in naturalistic and laboratory settings.

Research in Science Education
SED77-18914
$181,000
Award date: 09/23/77
Termination: 02/29/80
NSF Program Manager:
Dr. Andrew Molnar

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

INCREASING THE MEANINGFULNESS OF TECHNICAL INFORMATION FOR NOVICES

Dr. Richard E. Mayer
University of California
Santa Barbara, California 93106

The project will investigate instructional variables which may influence the way in which novices learn a new technical skill such as using a computer system. In particular this project focuses on the "priming" variables such as advance organizers which are intended to provide a meaningful context for learning new technical information, and the "mathemagenic" variables such as generating summary notes which are intended to force the subject to actively integrate and elaborate on the new material. The presentation modes will be both by CAI and video-taped lectures so that the effects of priming and mathemagenic variables can be assessed under a variety of conditions. Two methods will be used in order to assess the cognitive processes involved in learning and the structure of the learning outcomes. First, subjects will take multi-leveled post-tests consisting of both retention and transfer questions; this technique has been successfully used to assess the breadth of learning outcomes (Mayer, 1975). In addition, to add further depth of analysis, subjects will be asked to freely recall what they have learned and the protocols will be analyzed using current text analysis procedures (Meyer, 1975; Kintsch, 1974). These data will include the idea units recalled, the number of summary statements, the number of intrusions from other information, and the order of recall.

Research in Science Education
SED77-19875
$31,600
Award date: 09/23/77
Termination: 02/29/80
NSF Program Manager:
Dr. Andrew Molnar

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

A STUDY OF SCIENCE INSTRUCTIONAL PROGRAMS IN TWO-YEAR COLLEGES

Dr. Arthur M. Cohen
Center for the Study of Community Colleges
Los Angeles, California 90024

This is a study of curriculum and instruction in the sciences in the community, junior, and technical colleges of America. A sample of approximately 180 of the 1,213 (c.15%) colleges, balanced by college age, emphasis, locale, size, and control, is planned. The project staff will review the literature on the sciences in two-year colleges; tabulate all courses and class sections in the sciences, social sciences, engineering, and technology in the sample of colleges; survey a random 10% of the instructors (c. 1,600) teaching in those areas; cross-tabulate findings by discipline and type of college; prepare reports for widespread distribution.

The project will yield information on: the scope of the courses in all disciplines under NSF purview that are available to two-year college students; the magnitude of college effort in the sciences; course goals, materials, and equipment; instructional patterns; and changes in disciplinary emphases in recent years. This study will complement a similar study of humanities instruction now being conducted by the Center with support from the National Endowment for the Humanities. Findings will be of use to curriculum and instruction planners in all two-year colleges, college systems and consortia, universities, and state and federal agencies.

Research in Science Education
SED77-18477
$145,400
Award date: 9/23/77
Termination: 2/29/80
NSF Program Manager:
Dr. Raymond J. Hannapel

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

PROJECT SYNTHESIS: AN INTERPRETIVE CONSOLIDATION OF RESEARCH IDENTIFYING NEEDS IN PRECOLLEGE SCIENCE EDUCATION

Dr. Norris Harms
University of Colorado
Boulder, Colorado 80309

The purpose of this project is to develop a set of concise statements and more lengthy reports identifying in three sequential stages: 1) the important goals of science education, 2) the current state of science education, and 3) the needs of science education and recommendations for meeting those needs. These statements and reports will be interpretive consolidations of data soon to emerge from three NSF-funded major research studies addressing: a comprehensive review of needs-related research in science education practices and outcomes (Ohio State University), "Case Studies in Science Education" (University of Illinois), and a "Materials Usage Survey" (Research Triangle Institute), and from objectives and data from the National Assessment of Educational Progress. At each stage, interpretations will be made by five groups of expert consultants reflecting the five perspectives of: 1) Physical and Earth Science, 2) Biology, 3) Science Processes, 4) Science/Technology and Society Interaction, and 5) the Elementary School. At each stage, statements from these five groups will be synthesized into unified reports by the Synthesis Group. Results will be reported in three levels of specificity for three types of audiences: 1) policy makers, 2) educators in general, and 3) science educators.

Research in Science Education
SED77-19001
$203,300
Award date: 09/23/77
Termination: 08/31/79
NSF Program Manager
Raymond J. Hannapel

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

STRATEGIES FOR LEARNING EMPHASIZING THE NATURE AND ROLE OF CONCEPTS

Dr. Joseph D. Novak
Department of Education
and Biological Science
Cornell University
Ithaca, New York 14853

Previous research and theory development by this research group has been applied to instruction in college science classes and has supported the conclusion that concepts play a central role in the acquisiton of new knowledge and in problem solving. Working from the cognitive learning theory of Ausubel and employing ideas from the epistemology of Toulmin and others, prior studies have shown that college students can be taught strategies for learning that significantly influence their success in learning and problem solving. The current project seeks to extend this earlier work to the junior high school level. Using ordinary science lessons presented in schools, classroom instruction will be supplemented with special activities designed to teach the students the nature and role of concepts in psychological learning processes and the interplay between concepts and research methods in the creation of new knowledge in science. Preliminary informal work with students at the junior high level suggests that they can acquire the psychological and epistemological ideas to be taught and can use these to aid their understanding of conventional science instruction. This research project is designed to refine procedures for teaching strategies producing more effective student learning, and to assess the effectiveness of these procedures at the seventh and eighth grade level.

Research in Science Education
SED78-16762
$126,600
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Termination: 02-29-80
NSF Program Manager:
Dr. Andrew Molnar

RESEARCH INTO IMPORTANT FACTORS INFLUENCING FEMALE SELECTION OF FIRST OPTIONAL MATHEMATICS COURSES

Dr. Alma E. Lantz
Denver Research Institute
University of Denver
Denver, Colorado 80208

The research will apply the theories of social psychology and the methods of decision theory/choice behavior in order to predict the choices of young women facing their first optional mathematics course. The objectives are threefold: (1) to determine the relative importance of factors influencing math-related decisions, in order that the most important condition may be addressed by future experimental interventions; (2) to conduct a preliminary examination of the role of peer influence in making math-related decisions; and (3) to provide a more sensitive instrument with which to measure the effects of future interventions. Seven groups of approximately 30 students will be used as subjects. Three groups will be from Colorado: one from a rural area, one from an upper middle class private school, and one group of black and hispanic origin. Checks on the generalizability of the results will be conducted by having four similar groups complete the instruments in California. The steps in conducting the experiment will include the development of a preference scale, the administration of the preference scale to approximately 150 high school girls, the completion of the scale for her own preferences and the completion as she believes her best friend would complete the scale. The analysis will reveal differences in preference (value) structures by election of mathematics courses and demographic variables.

Research in Science Education
SED78-17103
$49,290
Award Date: 09-15-78
Termination: 02-28-81
NSF Program Manager:
Dr. Raymond J. Hannapel

THE USE OF HEURISTICS IN PROBLEM SOLVING: AN EXPOSITORY STUDY

Dr. Mary Grace Kantowski
University of Florida
Gainesville, Florida 32602

The purpose of this study is to explore regularities in problem solving behaviors that would suggest hypotheses for larger scale experimental studies dealing with (1) heuristic processes and (2) strategies for use in problem solving instruction. A clinical methodology will be employed. Subjects will be asked to "think aloud" as they solve problems. Most tests will be audio taped, selected ones videotaped. Protocols of problem solving behaviors will be coded and analyzed for processes indicated with particular attention to heuristics used and memory for previously encountered problems. Four categories of problems will be employed. Solution spaces for each problem will be documented. Results will be interpreted and hypotheses for future studies will be drawn up from the observations.

Research in Science Education
SED77-18543
$25,000
Award date: 09/23/77
Termination: 08/31/79
NSF Program Manager:
Dr. Raymond J. Hannapel

AN ANALYSIS OF RESEARCH ON MATHEMATICAL ABILITIES

Dr. Jeremy Kilpatrick
University of Georgia
Athens, Georiga 32609

The project will summarize and evaluate research findings relating to mathematical abilities. The project's goals are encompassed by four questions: (a) What does the literature say about mathematical abilities? (b) What is the structure of mathematical abilities? (c) What prototypic instruments might be used to assess mathematical abilities? (d) In what promising directions might research on mathematical abilities proceed? First, the literature will be searched, and a reference collection formed, by a team of 5 investigators (4 at the University of Georgia; 1 at the Institut für Didaktik der Mathematik, Germany). Second, the literature will be analyzed, evaluated, and used as the basis for a new conceptual framework for the study of mathematical abilities. Third, technical reports and monographs will be prepared that explain the framework, specify instruments for assessment, and point directions for future research and development activities. Each of the three phases of the project will take about the same total amount of time and resources, but activities in different phases will proceed concurrently. The approach will rely heavily on information-processing theories (and especially the work of Krutetskii); special attention will be given to spatial abilities. The conceptual framework and illustrative instruments will help teachers and researchers gather systematic information about children's mathematical abilities.

Research in Science Education
SED77-17946
$133,500
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Termination: 09/30/79
NSF Program Manager:
Dr. Raymond Hannapel

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

LEARNING AND TEACHING WHOLE NUMBERS: AN INTERDISCIPLINARY STUDY OF AN EXPERIMENTAL MODEL

Dr. Leslie P. Steffe
Department of Mathematics Education
University of Georgia
Athens, Georgia 30602

The goal of this project is to provide a model for learning and teaching whole numbers on the basis of recent advances in the psychology of cognitive development and the philosophy of mathematics. In both these fields a constructivist epistemology has come to the fore which has crucial implications for the conceptual development of children and their instruction. Whatever one's fundamental philosophical beliefs are concerning the "reality," there can be no doubt that children must construct their conception of reality out of their own experience, be it perceptual or conceptual.

For this premise the project will address four main tasks: (1) Critically review current literature pertaining to the development, learning, and teaching of the whole number system; (2) provide a theoretical framework in which the constructivist direction of cognitive psychology and of philosophy of mathematics can be exploited by mathematics education; (3) provide tentative models of the process that leads to the conceptualization of numbers and the operations performed on them; (4) point out and formulate researchable questions that could help to assess the adequacy of the constructivist approach to the problem of children's acquisition of the concepts involved in the whole number system and the methods used to teach it.

Research in Science Education
SED78-17365
$165,000
Award date: 09-15-78
Termination: 02-28-81
NSF Program Manager:
Dr. Raymond J. Hannapel

12/1978

A META-ANALYSIS OF PRODUCTIVE FACTORS IN SCIENCE LEARNING IN GRADES 6 THROUGH 12

Dr. Herbert J. Walberg
College of Education
University of Illinois
Chicago Circle
Chicago, Illinois 60680

The rationale for the study to be undertaken by this project is based on a NARST-NIE commission's (1975) recommendations for research review, the Glass (1978) methodology of meta-analysis, and recently identified constructs in the general education literature related to student learning.

The study will review and analyze up to 15 years of science education research literature related to those major causal constructs which the general education literature is pointing to as highly related to student learning. The statistical methodology employed will be meta-analysis as described by Glass (1978). Meta-analysis of the research on the following eight constructs as they relate to science learning in grades 6 to 12 is planned: student age, ability (including developmental level), and motivation; quality and quantity of instruction; and classroom, home, and peer environments.

The analysis to be employed in this study will not only test the validity of the hypothesized relationship of the constructs to student learning in science, but will be a basis for identifying gaps in the research literature and designing future studies to further elucidate causal variables. The study will also provide policy makers with a comprehensive, quantitatively based guide to what is known about the major factors influencing science learning.

Research in Science Education
SED78-17374
$129,200
Award date: 09-15-78
Termination: 08-31-80
NSF Program Manager:
Dr. Raymond J. Hannapel

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

RESEARCH ON THOUGHT PROCESSES USED IN 7TH-10TH GRADE MATHEMATICS

Dr. Robert B.Davis
University of Illinois
Urbana, Illinois 61801

For various reasons, the "new mathematics" curricula of the 1960's had (in most cases) to be created in the absence of an adequate basis of task analysis. This is no longer the case. In order to provide a more secure foundation for curriculum improvement efforts in the future, this project will carry out both "theoretical" and "empirical" task analyses for the tasks of learning 7th - 10th grade mathematics. For the various tasks of this mathematics, the project will try to answer the question: just what thought processes are necessary in order for a student to learn to perform this task correctly? For a "theoretical" analysis one studies the task itself, and asks "what seems to be necessary?" For an "empirical" analysis, one observes a student working at the task, and asks "what does he actually do?" The empirical analysis uses a modification of Piaget's "clinical interview method" -- as the student solves the problem, and interviewer poses questions such as: "How did you decide to divide, just now?"

Research in Science Education
SED77-18047
$143,900
Award date: 09/23/77
Termination: 02/29/80
NSF Program Manager
Dr. Thomas J. Cooney

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

MEASUREMENT AND ANALYSIS OF PATTERNS OF LOGICAL THINKING

Dr. Frederick P. DeLuca
Iowa State University
Ames,Iowa 50011

The purpose of this research is to develop a system for recording and measuring logical thinking, and to test the system in three experiments designed to study: 1) the ability of subjects to demonstrate logical thinking with different kinds of science content, 2) patterns of logical thinking under global and differentiated approaches to problem solving, and, 3) automation of data collection.

Previous research suggests that electronic forms of piagetian tasks can be combined with recent advances in microcomputer technology to overcome many deficiencies found in the original tasks. This approach has the advantages of greater flexibility and sharper control of number and intensity of variables. The entire subject-task interaction can be recorded so valuable data that are usually lost by current techniques can be retained and analyzed. Development of such an instrument could lead to improved measurement of patterns and levels of logical thinking, open doors to new experiments, and help produce the knowledge that is necessary to reduce the gap between Piaget's Theory and its application in the classroom.

The study seeks to produce new information concerning the relations between science content, gender of the subject, and patterns of logical thinking under differentiated and global approaches to problem solving; such information will be of interest to researchers, curriculum developers, and science teachers.

Research in Science Education
SED77-18654
$52,300
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Termination: 02/29/80
NSF Program Manager:
Dr. Andrew Molnar

12/1978

A RESEARCH STUDY OF COMPUTER-BASED TUTORING OF MATHEMATICAL AND SCIENTIFIC KNOWLEDGE

Dr. Ira P. Goldstein
Massachusetts Institute of Technology
Cambridge, Massachusetts 02139

Over the next five years, computer games will find their way into many American homes, creating a unique educational opportunity. From the user's perspective, the computer will provide advice regarding strategy and tactics for better play. But from the educational perspective such requests for help provide an opportunity to tutor basic mathematical, scientific or other kinds of knowledge that the game exercises.

There are, however, critical research issues which must be addressed. While the hardware needed for games and computer-based tutoring will continue to drop in cost, the software technology (and related educational and psychological theory) for designing competent computer-based tutors does not yet exist. This project seeks to develop a theory and a design for such systems, to implement prototypes, and to experiment with their ability to convey important intellectual skills.

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$193,400
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NSF Program Manager:
Dr. Andrew R. Molnar

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

ASSESSMENT AND DOCUMENTATION OF A CHILDREN'S COMPUTER LABORATORY

Dr. Seymour A. Papert
Massachusetts Institute of Technology
Cambridge, Massachusetts 02139

This research will thoroughly document the experiences of a small number of 5th grade children in an elementary school computer laboratory, using LOGO, an advanced computer language designed for children. Four groups of four children will be taught a 10-week LOGO course. Detailed anecdotal records will be kept, and observers will note the development of the children's computer programming skills, and the acquisition of knowledge in the areas of mathematics, science, and language, and of cognitive strategies and attitudinal changes which transfer beyond the specific subject matter studied. A collaborative team, including MIT research scientists, a public school teacher and curriculum evaluation from Education Development Center, will conduct the research. A final report will be prepared by the project staff, summarizing the experiences of each child, as well as drawing conclusions from the collective data about the success of the LOGO classroom experience in helping children acquire skills and knowledge in the target areas. The success of the assessment methodology will be discussed and strategies suggested for a large scale evaluation to be conducted in the future.

Research in Science Education
SED77-19083
$180,700
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NSF Program Manager:
Dr. Andrew R. Molnar

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

IDENTIFYING DIFFERENT LEVELS OF UNDERSTANDING ATTAINED BY PHYSICS STUDENTS

Dr. Frederick W. Byron, Jr.
University of Massachusetts
Amherst, Massachusetts 01003

The use of formulas in mathematics and the physical sciences is a necessary and extremely powerful technique. However, science students in secondary schools and colleges often memorize large numbers of formulas with little understanding of their underlying meaning. There is preliminary evidence that this happens to a greater extent than is commonly recognized. The clinical interview offers a technique for studying and documenting ways students use and misuse formulas. This project will 1) investigate the extent to which introductory college physics students misuse or misunderstand formulas, 2) catalogue the typical ways in which they do this, and 3) begin the larger task of identifying key types of knowledge that successful problem solvers use to give formulas meaning. This will be done by conducting clinical interviews and written tests with students taking introductory college physics. This type of study should help interest faculty in the process of increasing the level of understanding their students attain as opposed to merely increasing formula-shifting competence.

Research in Science Education
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$20,900
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Termination: 06/30/79
NSF Program Manager:
Dr. Thomas Cooney

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

STATISTICAL ANALYSIS OF RESEARCH RESULTS IN COLLEGE SCIENCE TEACHING

Dr. James A. Kulik
University of Michigan
Ann Arbor, Michigan 48109

The major objective of this project is the collection and statistical analysis of comparative studies of effectiveness of instructional technology in college science teaching. The basic data for the analysis will come from hundreds of studies of instructional technology reported in journal articles, technical reports, and dissertations. Project staff members will collect these primary data analyses, summarize results, and statistically analyze the collected outcomes of these studies. They will characterize each study along a number of dimensions, including characteristics of the setting, conditions of the study, and methodological adequacy of comparisons. A number of measures of effectiveness will be used in the study.

The project should generate new knowledge about the effectiveness of different instructional technologies used in college science teaching. The analysis should say how effective each of the technologies is, under what conditions, and for which criteria. Beyond this, the project will provide an example of statistical analysis of a large collection of reported research results. The study should identify current standards for reporting results of educational research, and project staff expect to be able to make suggestions about more uniform standards for future reports.

Research in Science Education
SED77-18566
$114,300
Award date: 10/20/77
Termination: 09/30/79
NSF Program Manager:
  Dr. Raymond Hannapel

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

A STUDY OF COMPUTER USE AND LITERACY IN SCIENCE EDUCATION

Dr. Daniel Klassen
Minnesota Educational Computing
Consortium
St. Paul, Minnesota 55113

Computers are having a significant influence on the content of science education and the teaching of science at the pre-collegiate level. This study will examine the impact on computer literacy--student knowledge, attitudes and skills vis-a-vis computers--of instruction about the operation and use of computers and of student use of the computer in an instructional setting. Using a field study approach, the project will measure computer literacy levels before and after instruction about computers. Using a controlled laboratory approach, the study will measure computer literacy levels before and after using a computer within the context of science education.

The project addresses itself to an important aspect of science education as it is practiced in American schools and is designed to produce information which will allow science educators to better measure and develop educational programs.

Research in Science Education
SED77-18658
$184,100
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Termination: 02/29/80
NSF Program Manager:
Dr. Andrew Molnar

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

A STUDY OF PRIORITIES IN SCHOOL MATHEMATICS (PRISM)

Dr. Alan Osborne
National Council of Teachers of Mathematics
Ohio State University
Columbus, Ohio 43210

The PRISM Project Study is designed to illuminate differences between actual and desired practices in mathematics curricula (K-14) with their implications for research and development. Using a broad model based on topical areas in mathematics and encompassing the tools and modes of instruction, the project will survey the preferences and priorities of users, makers and purchasers of mathematics curricula. The work is divided into six components as follows: 1) Synthesize evidence on practices from the literature and from research and related exploratory activities such as the three NSF-funded needs/practices studies currently in progress; 2) using component 1 as a base, develop survey instruments which state options for alternative practices within given topical areas in mathematics education; 3) survey the preferences of users, makers, and purchasers of mathematics curricula for practices within topical areas; 4) given these established preferences within topical areas, a follow-up survey will be used to determine priorities across topical areas; 5) compare the information on preferences with the research/knowledge base in order to identify discrepancies between "what is" and "what ought to be"; 6) conduct feasibility analyses to identify needed research and development to address the discrepancies identified in component 5.

Research in Science Education
SED77-18564
$192,600
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Termination: 03/31/80
NSF Program Manager
Raymond J. Hannapel

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

PSYCHOLOGICAL PROBLEM SPACE AND MOTIVATION IN ADOLESCENT LEARNING: A STUDY OF INFORMATION PROCESSING

Dr. Donald W. McCurdy
Department of Secondary Education
University of Nebraska
Lincoln, Nebraska 68588

This study hypothesizes the existence of differential problem conceptualizations among junior high school science students. Through a combination of a structured interview and data obtained from a variety of individual differences instruments, regularities in the nature of students' "problem space" will be sought. The writers hypothesize that the "problem space" as seen from the perspective of relatively naive science students will provide substantial information relating to (a) the ways in which science curriculum materials are prepared, and (b) goals of enhancing student interest in, and motivation toward, the science curriculum

One hundred fifty junior high school students will be exposed to a carefully chosen set of science problems selected from the science curricula in use in their schools. Each student will be administered the problem separately, accompanied by a set of structured probes which will be designed to provide a description of how the student views the problem--his/her "problem space." Coupled with examination of the student scores on a set of individual attribute variables, the data will be analyzed in a multivariate analysis of variance format, to examine the effects of various student characteristics such as age, sex, cognitive style, etc., on problem performance. The interview data will be used more descriptively to construct, if possible, a general description of the "problem space" junior high students bring to the science curriculum. It is anticipated that this may vary across age and experience with science.

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Termination: 02-28-81
NSF Program Manager:
Dr. Andrew Molnar

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

RESEARCH STUDIES ON THE SCIENTIFIC LITERACY OF THE ATTENTIVE PUBLIC

Dr. Jon D. Miller
Northern Illinois University
DeKalb, Illinois 60115

The research will examine the applicability of a stratified public opinion model of scientific literacy. The models proposed by G. Almond in The American People and Foreign Policy and by D. Devine in The Attentive Public: Polyarchical Democracy provide an original framework.

The research will seek (1) to develop an operational definition and to measure the current size, composition, and structure of the attentive public for organized science, (2) to construct a developmental pre-audit model, and (3) to assess the level of scientific literacy of the attentive public and to determine any science education and information needs.

The construction of a developmental pre-adult model will require parallel national studies of high school students and college students to measure interest and information levels and to identify correlates of higher levels of science interest. The development of an operational definition of the adult attentive public will utilize a retrospective analysis of a 1958 Survey Research Center study of science media consumption and will incorporate developmental factors identified in the pre-adult model. The operational definition will be used to study a sample of adults, allowing the construction of a model of the adult attentive public.

Once the pre-adult and adult models are completed, an assessment will be made of the level of scientific literacy and the special science education and information needs of the attentive public.

Research in Science Education
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$67,800
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Termination: 12/31/79
NSF Program Manager:
Dr. Andrew R. Molnar

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

A REVIEW OF RESEARCH ON SOLVING ROUTINE PROBLEMS IN PRE-COLLEGE MATHEMATICS

Dr. Larry Sowder
Northern Illinois University
DeKalb, Illinois 60115

Routine problems in mathematics require only limited analyses for their solutions, whereas nonroutine problems require considerable ingenuity for solution. The usual verbal problems in mathematics textbooks are, for example, routine problems.

The goals of this project are:

1) To review and critique research related to routine problem solving in precollege mathematics;

2) to identify directions for research in routine problem solving in mathematics; and

3) to disseminate the findings to teachers and researchers.

Goal 1 calls for a literature search and critique; this search and critique will be used for goal 2 also. Articles prepared for journals for mathematics teachers and researchers, notes in an existing newsletter, and papers presented at professional meetings will be used for the dissemination of the findings (the third goal).

Research in Science Education
SED77-19157
$35,000
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NSF Program Manager
Dr. Raymond Hannapel

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

THE RELATIONSHIP BETWEEN STUDENT ATTITUDES TOWARD THE SCIENCE CURRICULUM AND SELECTED VARIABLES

Dr. Thomas M. Haladyna
Education/Development Research Program
Oregon State System of
  Higher Education
Monmouth, Oregon 97361

Motivated by a large-scale study of students' attitudes toward science and other subject matters recently performed by the principal investigator and colleagues, the purpose of the current research is to study the relationship between teacher, school, student, and environmental variables and student attitudes across the dimensions of three curricular areas in science (i.e., science, mathematics, and social studies) and three grade levels (four, seven, and eleven) for 270 teachers and their respective students, approximately 6000.

A review of current literature reveals the lack of coordinated and comprehensive research of this type across the dimensions described above. Further, most studies of attitudes fail to provide a theoretical base as well as a multivariate methodology, which has greater potential for uncovering complex relationships that seemingly exist.

Products of this proposed project include (a) the research study, (b) a review of salient research, (c) a review of instruments used to measure attitudes, (d) a sourcebook of these instruments, and (e) two technical reports documenting the study of the reliability and validity of the instruments employed in the study.

Research in Science Education
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  Dr. Raymond J. Hannapel

12/1978

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

DETERMINANTS OF STUDENT ENTRY AND PERFORMANCE IN THE SCIENCES

Dr. George H. Dunteman
Research Triangle Institute
Research Triangle Park, North Carolina 27709

The primary purpose of this study is to determine social, psychological, and structural factors that influence the entry of women and ethnic minorities into science education and their subsequent performance. Data will be drawn from the base-year and three subsequent follow-up surveys of the National Longitudinal Study of the High School Class of 1972. Separate analytical models will be used to examine each of the following critical periods in science career development: the transition from high school to college, completion of college, and the transition from college to work or to graduate school. This study will be conducted by a team of investigators with diverse experiences in science education, educational research, and career development. The study will be completed within a year, beginning in October 1977.

Research in Science Education
SED77-18928
$65,300
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Termination: 03/31/79
NSF Program Manager
Dr. Thomas J. Cooney

AN INQUIRY INTO THE GRADUATE TRAINING NEEDS OF TWO-YEAR COLLEGE TEACHERS OF MATHEMATICS

Dr. Robert McKelvey
Rocky Mountain Mathematics Consortium
c/o Arizona State University
Tempe, Arizona 85281

The purpose of this study is to appraise advanced professional training needs of two-year college teachers of the mathematical sciences, as they themselves see these needs. It is intended at the same time to draw a profile of the relevant characteristics of the current two-year college teaching population. The principal instrument for measuring these things will be a mail questionnaire, formulated and pretested through a series of intensive site visits to selected two-year colleges by the investigating team. In addition to reporting views and attitudes of two-year college mathematics teachers, the project will seek to develop a model to help meet the educational needs of current and prospective teachers.

Research in Science Education
SED77-18924
$25,000
Award date: 09/23/77
Termination: 02/28/79
NSF Program Manager:
Dr. Thomas Cooney

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

THE ROLE OF COGNITIVE STYLE IN THE LEARNING OF MATHEMATICS: A RESEARCH STUDY

Dr. Douglas B. McLeod
San Diego State University
San Diego, California 92182

Individuals differ in their preferred approaches to learning mathematics. These differences are often referred to as cognitive styles. Learning can be maximized when a given cognitive style is matched with an appropriate instructional treatment. This research project involves identifying relevant cognitive styles, developing appropriate instructional treatments, and conducting experiments to test the relationship between cognitive style and the effectiveness of various instructional treatments in mathematics.

One cognitive style variable, field-dependence-independence, has been used in several experiments and shown to be important. The results indicate that students with a field-independent cognitive style learn mathematics best when given the opportunity to discover concepts with minimal guidance, while field-dependent students achieve most in a more expository treatment. This research will be expanded to new content areas in mathematics, to new instructional aids like hand-held calculators, and to other cognitive style variables.

Research in Science Education
SED77-18531
$25,000
Award date: 09/23/77
Termination: 02/28/79
NSF Program Manager:
Dr. Andrew Molnar

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

AN INVESTIGATION ON THE EFFECT OF FIELD TRIPS ON SCIENCE LEARNING

Dr. John H. Falk
Smithsonian Institution
Chesapeake Bay Center for Environmental Studies
Edgewater, Maryland 21037

Despite the ever increasing prevalence of outdoor-centered science field trips, virtually nothing is known about the effects of outdoor settings on learning. This project will carry out a series of three studies which, building upon past and current research at the Smithsonian Institution's Cheasapeake Bay center for Environmental Studies, seeks to increase our understanding of student learning and behavior during outdoor field trips and to provide suggestions allowing for considerable improvement in the efficacy of outdoor-centered education.

The first study deals with the field-trip milieu in order to determine how the constellation of environmental factors surrounding the usual field trip (e.g., day away from school, disruption of normal schedules, bus rides) interact with learning and behaviors. Cognitive, affective and psychomotor dimensions will be analyzed. Study two will be a survey of a representative nation-wide sample of elementary school teachers, elementary school principals, college science methods instructors, and nature center professionals to assess attitudes and perceptions toward field trip experiences for children. Data will be used to help explain observed behaviors as well as to provide a framework for future recommendations. The third study focuses on the effects of setting novelty and number of available relevant examples on field trip behavior and learning; research suggests that these two elements represent major components in the field trip learning matrix. The study will allow for simultaneous manipulation of these two dimensions.

Research in Science Education
SED77-18913
$24,300
Award date: 09/23/77
Termination: 02/28/79
NSF Program Manager:
Dr. Thomas Cooney

NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

SOCIAL STUDIES/SOCIAL SCIENCE EDUCATION: PRIORITIES, PRACTICES AND NEEDS

Dr. Irving Morrissett
Social Science Education Consortium, Inc.
855 Broadway
Boulder, Colorado 80302

The project will analyze and interpret existing data, for the purpose of providing concise statements on (1) goals and desired states of social studies/social science education, (2) the current state of social studies/social science education, and (3) critical needs and recommendations for social studies/social science education. The principal data bases for the project will be the social science components of three recently completed NSF studies of research on trends and needs, materials usage, and classroom practices in science education, plus data from National Assessment of Educational Progress on social studies, citizenship, and coping skills; other relevant data may also be used. Three Focus Groups will concentrate on studies of elementary, junior high, and senior high social studies programs respectively, making separate reports on goals, current state and critical needs for each level. These reports will be synthesized into K-12 summaries and executive summaries by a Core Group which has overlapping membership with the Focus Groups and has major responsibility for planning and executing the entire project. Staff members and consultants for the project will include persons from throughout the nation experienced at all levels of social science education, K-12, and in all phases of social science education, including classroom teaching, curriculum planning, materials and curriculum development, research, supervision, and administration. The project outcomes will be useful to persons engaged in these same educational roles at national, state, and local levels.

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NSF Program Manager:
Dr. Raymond J. Hannapel

12/1978

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SEX DIFFERENCES IN PERCEPTUAL, MOTOR AND COGNITIVE SKILLS AS RELATED TO MATHEMATICS AND SCIENCE

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Data on sex differences in intellectual ability show that females succeed in arts-based subjects, especially those involving language whereas males excel in the sciences, especially mathematics and physics. Both findings are supported by behavioral and EEG studies showing different cognitive styles. A common theory is that this difference is socially determined, though few logically coherent arguments can be presented to explain all data equally well. It is the thesis of this study that sex differences in cognitive aptitude stem from early sensory-motor biases which program neural systems differently. These biases are not immutable but, unless they are recognized, programs designed to help males with language and females with science will proceed on false assumptions, on a trial and error basis. Studies carried out on sex differences in perception show that the sexes have different auditory and tactile sensitivities and two or perhaps three distinct modes of processing visual information. Males and females are also distinguished by different qualities of motor skills: gross-motor superiority in males and fine-motor superiority in females. This research seeks to extend our knowledge of the precise relationship of perceptual motor systems to cognitive processing. The studies will focus on behavioral testing and on mapping patterns of brain wave activity during problem-solving tasks. Males and females and other relevant groups such as efficient and inefficient problem solvers will be examined in mathematical and spatial reasoning tasks.

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NSF Program Manager:
Dr. Andrew Molnar

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NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

INVESTIGATION OF CONCEPTUAL DEVELOPMENT IN THE STUDY OF MOTION

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This project willl study students' development of understanding of the scientific concepts used to describe and explain motion. The research has two components:

(1) Investigative Component--The study will identify and describe in detail preconceptions, misconceptions and other conceptual difficulties experienced by college students before, during, and after their study of motion. The investigation of conceptual development will include students who are enrolled in various introductory level physics courses and who exhibit a wide range of reasoning patterns--from primarily concrete to primarily formal. Among the student populations to be studied are students in both calculus and non-calculus general physics courses, pre-professional minority students, and inservice pre-college teachers.

(2) Instructional Component--The project will apply the acquired information to the development of special methods and materials for more effective teaching of kinematical and dynamical concepts and will study the effect with minority and other academically disadvantaged students who aspire to science-related careers but who exhibit primarily concrete reasoning patterns.

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Dr. Raymond J. Hannapel

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WASHINGTON, D.C. 20550

RESEARCH ON RELATIONSHIP OF SPATIAL VISUALIZATION AND CONFIDENCE TO MALE/FEMALE MATHEMATICS ACHIEVEMENT IN GRADES 6-8

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Because of the necessity to understand reasons explaining the underrepresentation of women in mathematics-related careers, the most important cognitive and affective factors related to sex differences in mathematics (i.e., spatial visualization and feelings of confidence/anxiety toward mathematics) have been selected for study. Their stability, factors related to their development and their effect upon mathematical problem solving will be investigated.

The objectives of the project are (1) to determine the influence of spatial visualization, and confidence/anxiety upon sex-related differences in mathematics, (2) to ascertain the development and stability of these influences by studying the same students over a three-year period, and (3) to ascertain if confidence/anxiety is related to the cognitive processes used in problem solving.

Three groups of students in Grades 6-8 will be identified; females and males who are (1) discrepant in spatial visualization and verbal skills, (2) discrepant in mathematics achievement and confidence in learning math and (3) a control group. These subjects will be studied over a three-year period through structured, individual interviews and written tests. Both females and males will be studied because of the necessity of understanding what factors differentiate females and males continuing their study of mathematics.

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  Dr. Raymond J. Hannapel

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SYSTEMATIC INVESTIGATION OF THE COGNITIVE EFFECTS OF GAMES ON MATHEMATICS LEARNING

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The long-term goal of this project is to investigate systematically the cognitive effects of games on mathematics learning over the range from kindergarten through the 9th grade.

During the first year of project operation, four studies focusing on the influence of games on mathematics learning at the elementary school level were completed and are at various stages in the publication process. The current amendment provides support for four additional studies that cover grades 5 to 9 and that will help to achieve the long-term goal in 1978-79. The first study would investigate the effects of two logical reasoning games upon sixth- and eight-grade students. The second study would investigate the relationship between the instructional level of a game and achievement grouping; seventh-grade students would play concept and skill games while grouped homogeneously and heterogeneously. The third study would investigate differences in achievement when game players are (1) expected to manipulate physical objects, (2) expected to manipulate pictorial representations of objects, or (3) expected to make only symbolic manipulations. Fifth- and seventh-grade students would play games in which they compare and order fractions. In each of these studies the students would be randomly assigned to treatment groups and would be given pre- and post-tests to determine what changes occur. The fourth study would be a two-phase exploratory study designed to discover what problem solving heuristics are used by experienced and novice problem solvers while playing two computerized variants of the game NIM.

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NATIONAL INSTITUTE OF EDUCATION - NATIONAL SCIENCE FOUNDATION

COLLABORATIVE PROGRAM ON

RESEARCH ON COGNITIVE PROCESSES AND THE STRUCTURE OF KNOWLEDGE IN SCIENCE AND MATHEMATICS (E)

University of California, Irvine 1
Carnegie-Mellon University 2
Clark University 3
Harvard College 4
Illinois State University 5
University of Massachusetts 6
Northwestern University 7
University of Pittsburgh 8
Stanford University 9
University of Texas 10
University of Virginia 11

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UNDERLYING HEURISTIC AND FORMAL STRUCTURES OF PROBABILISTIC THOUGHT

Dr. Michael D. Butler
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University of California at Irvine
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This project will take two approaches to investigating how people think about and make judgments about probabilistic matters. One approach is to study the strategies that children and adults use in confronting probabilistic problems, particularly those strategies that commonly lead in certain situations to consistently wrong answers. The project will look at what these strategies are, how children's strategies develop into adult strategies, when various strategies are used, how they are interrelated, and how they might be altered. Knowing how and why people arrive at wrong conclusions about probability can help in the development of more effective ways of teaching probability.

A second approach considers formal, deductive models of the structure of probabilistic thought. Probability theory as usually taught may be cognitively unnatural, not in its results but in its development from what is assumed to what is deduced. By extending current revisions of standard probability theory to reflect more closely human cognition, the project seeks to create and test models which will be both mathematically sound and psychologically more valid than the standard theory development. Revising the teaching of probability in the light of such models can make it easier for students to learn probability.

The experimental work will be conducted at the University of California, Irvine, with the cooperation of elementary school children and young adults.

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NSF Program Manager:
Erik D. McWilliams

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COGNITIVE PROCESSES AND THE STRUCTURE OF KNOWLEDGE IN PHYSICS AND ALGEBRA

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While many of the general mechanisms of human problem solving are known today, much remains to be discovered about how these mechanisms interact with competence in particular subjects like physics or mathematics. The proposed research will build detailed, substantiated models of expert (graduate student and professional) problem solving in elementary physics and algebra; will compare expert and novice performance, and will analyze the learning mechanisms that gradually transform novice into expert.

Laboratory experiments with expert problem solvers and analyses of their verbal protocols while solving problems will provide the basic data for building computer simulation models of their performance. These models make it possible to detect the full range of components of problem solving skill, and especially to discover components that may be overlooked in ordinary instruction.

The work is aimed at developing basic knowledge of problem solving and learning processes in physics and algebra that can be used to improve curriculum design and textbooks in these subjects, to diagnose students' learning diffculties, and to design remedial treatment for such difficulties.

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WASHINGTON, D.C. 20550

ANALYSIS OF THE DEVELOPMENT OF PROPOSITIONAL REASONING

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This project investigates how the logical form and the content of logical problems affect the reasoning process, particularly whether the effect of problem content differs for problems of different logical forms. Children will be presented a number of problems of a given logical form, will give their answers, and will be told the correct answer. A test will then assess whether children have abstracted the concept of the rule, and how general a concept they acquired. Two experiments, conducted in the school setting in Worcester public schools, will address those questions. The studies of content effects will be conducted in the Child Laboratory at Clark University. Children will be presented problems of different logical forms and different content on a computer screen, and their responses and response time will be recorded. Subjects in the project are second through seventh graders in Worcester Public Schools.

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THE DEVELOPMENT OF APPLIED SCIENTIFIC THINKING IN CHILDREN AND ADOLESCENTS

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The goal of the proposed project is to describe the development of applied scientific thinking in children and adolescents and to evaluate the usefulness of the Piagetian "stage" model for characterizing developmental thought patterns. A review of the literature supports the contention of a relationship between Piaget's stages of cognitive development and scientific knowledge; however, there is a scarcity of empirical data to back up this claim. Most importantly, there appears to be little information about the specific nature of applied scientific thinking in children and adolescents. The proposed study will make use of the in-depth, structure interview about scientific phenomena presented to the subject at the time of assessment (e.g., electromagnetism). Two studies will be undertaken. In Study I, a cross-section of subjects, from first graders to college freshmen, will be interviewed on three measures of Piagetian cognitive development and our experientially based tasks of scientific thinking. In Study II, groups of fourth and seventh graders from a public school will take part in a year-long series of weekly laboratory experiences. A weekly assessment of applied scientific thinking through a laboratory debriefing interview will allow for a longitudinal analysis of development. A time series of multiple, successive observations of the same individual will permit a refined description of growth curves in applied scientific thinking.

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Erik D. McWilliams

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THE REPRESENTATION AND LEARNING OF KNOWLEDGE STRUCTURES IN EXPERIMENTAL PSYCHOLOGY

Leon Manelis
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The proposed work would focus on the logic of research methods in psychology, or "experimental psychology." The importance of this subject for students is that it offers some basic forms for analytical thinking. The proposed research would attempt to describe the content of experimental psychology in formal ways. The formalisms come from recent developments in psychology and linguistics which allow written language to be decomposed into component ideas and then to be represented mathematically. These formal methods would be applied to textual materials, to descriptions written by teachers, and to materials produced by students. Using these methods, the proposed research would investigate the learning of students from textbooks. In addition to its value for science education, the proposed research is intended to develop the methods of analyzing language. The research would be conducted at Illinois State University, and the people studied would be college students.

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Erik McWilliams

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THE ROLE OF PRECONCEPTIONS & REPRESENTATIONAL TRANSFORMATIONS IN UNDERSTANDING SCIENCE AND MATHEMATICS

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Amherst, Massachusetts 01003

Techniques for investigating human thought processes have evolved to the point where they can now be applied to such topics as college level physics and mathematics. Instruction in these areas has traditionally suffered because teachers have been unable to understand the nature of the difficulties students have with such material. Our own studies in physics over the past two years indicate that we can make first-order analyses of student thought patterns which reveal many of the reasons behind their learning difficulties. We have also shown that this knowledge can be used to improve instruction. In this project we will expand the range of our investigations to additional topics in physics, mathematics and statistics. The two major goals of the project are to: (1) produce taxonomies, in several subject areas, of students' preconceptions and misconceptions that are relevant to instruction, and (2) identify the types of difficulties students have in translating between different representational systems.

We will conduct a series of interviews with University of Massachusetts undergraduate students taking introductory statistics and physics courses. These interviews will be analyzed in detail to determine the structure of the students' preconceptions and misconceptions. Our results will have important implications for several critical areas of cognitive science including the theory of representation and the nature of control structures.

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Erik D. McWilliams

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THE LOGICAL, MATHEMATICAL, AND PSYCHOLOGICAL STRUCTURE OF COUNTING AND OF EARLY NUMBER CONCEPTS

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This research proposal is directed towards three questions:

- What are the knowledge and skill components of the act of counting?
- How and when do children use the strategy of counting objects to construct other early number concepts?
- How and when do children use the rote string of number names to construct early number concepts?

The initial focus of this project will be the construction of a detailed and comprehensive structural summary of the knowledge and skill components of counting and of early number up through simple addition and subtraction. Components of this summary will be derived from logical and mathematical analysis of counting and of early number, from previous research, and from pilot work with children. The project team devising this model will represent the disciplines of mathematics, logic, psychology, and education. Three major empirical studies on the use of counting strategies by preschool and elementary school children will be conducted on key components of the structural summary. Results from these studies will be used to modify the summary. This structural summary will permit the integration of past research into a coherent whole and will enable future efforts to be focused in fruitful areas. The summary will also facilitate evaluation of present curriculum materials and classroom practice and will enable diagnostic materials to be developed.

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Erik D. McWilliams

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WASHINGTON, D.C. 20550

INVENTION AND UNDERSTANDING IN THE ACQUISITION OF COMPUTATION

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This research is concerned with the role of invention in the learning of elementary school mathematics and with the kinds of knowledge structures that underlie successful invention. Focussing on the topic of place value and the computational algorithms based on it, a combination of rational task analysis, empirical study, and theoretical analysis will be used to address three questions: (a) Under what conditions does invention play an important role in the acquisition of routines for calculation? (b) What kinds of knowledge structures underlie [illegible] inventions? (c) What kinds of representations for teaching will facilitate acquisition of computational competence? Rational analysis will be used to specify relationships between mathematical structures and calculation procedures and to generate a set of candidate instructional routines. Empirical research will consist of longitudinal descriptive studies of individual children and of instructional studies in which attempts are made to correct children's misunderstandings or to provide representations of concepts that will block development of these misunderstandings. Theoretical analysis, which will be subjected to the discipline of computer simulation, will be aimed at developing a theory of individuals' understanding of arithmetic at given points in their development and at accounting for the processes of invention. The individuals to be studied will be elementary school mathematics students from local schools.

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RESEARCH ON PROCESS MODELS OF BASIC ARITHMETIC SKILLS

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Institute for Mathematical Studies
in the Social Sciences
Stanford CA 94305

The objective of this project is to extend process models of basic skills in arithmetic to a deeper level of psychological detail, especially in the area of perceptual components of the algorithms required in basic skills tasks. Research goals include the study of individualizing instruction in arithmetic by the use of process models including aspects of visual perception. In addition we hope to benefit the sample population of children during this study by providing individualized computer-assisted instruction in basic arithmetic skills.

A register machine model for counting, addition, subtraction, multiplication and possibly division will initially be developed, tested and refined. Extensive data, collected automatically by computer, will be used to evaluate the models developed.

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Erik D. McWilliams

PSYCHOLOGY OF EQUATION SOLVING: AN INFORMATION PROCESSING STUDY

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The way in which college students solve simple algebraic equations will be studied by collecting protocols, written solutions with spoken explanations and comments from the student. Two groups of students, representing poor and fluent solvers, will participate. Information from the protocols will be used to extend an existing model of the solution process to give an understanding of the mechanisms underlying common errors and the distinguishing features of efficient solving methods. Besides being of theoretical importance to cognitive psychologists working on problem-solving, this analysis should be of value to mathematics educators. The research will be carried out at the Mathematics Education Center at the University of Texas at Austin.

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NATIONAL SCIENCE FOUNDATION
WASHINGTON, D.C. 20550

LEARNING FROM SCIENCE AND MATHEMATICS TEXTBOOKS: TEXT STRUCTURE, READING STRATEGIES AND COMPREHENSION

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The proposed research is designed to build a theoretical and empirical foundation for the development of better textbooks in mathematics and science and better diagnostic and instructional techniques for teaching the kind of reading demanded by math and science textbooks. The project brings together experts in the teaching of math, science, and reading, with experts in psycholinguistics, cognitive psychology, and psychometrics to observe the behavior of freshmen and sophomores at the University of Virginia as well as seventh and tenth graders in the Virginia school system while they study and take tests on typical math and science reading assignments. The major thrust will be on the development of new ways of exploring the interrelationships among the characteristics of individual students, the formal and perceived text structures, the reading strategies, and the quality of comprehension of math and science textbooks. This will get at the heart of important theoretical and practical issues since the mental abilities and study skills necessary for success in learning math and science are inextricably interwoven with the ability to read and comprehend math and science textbooks.

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